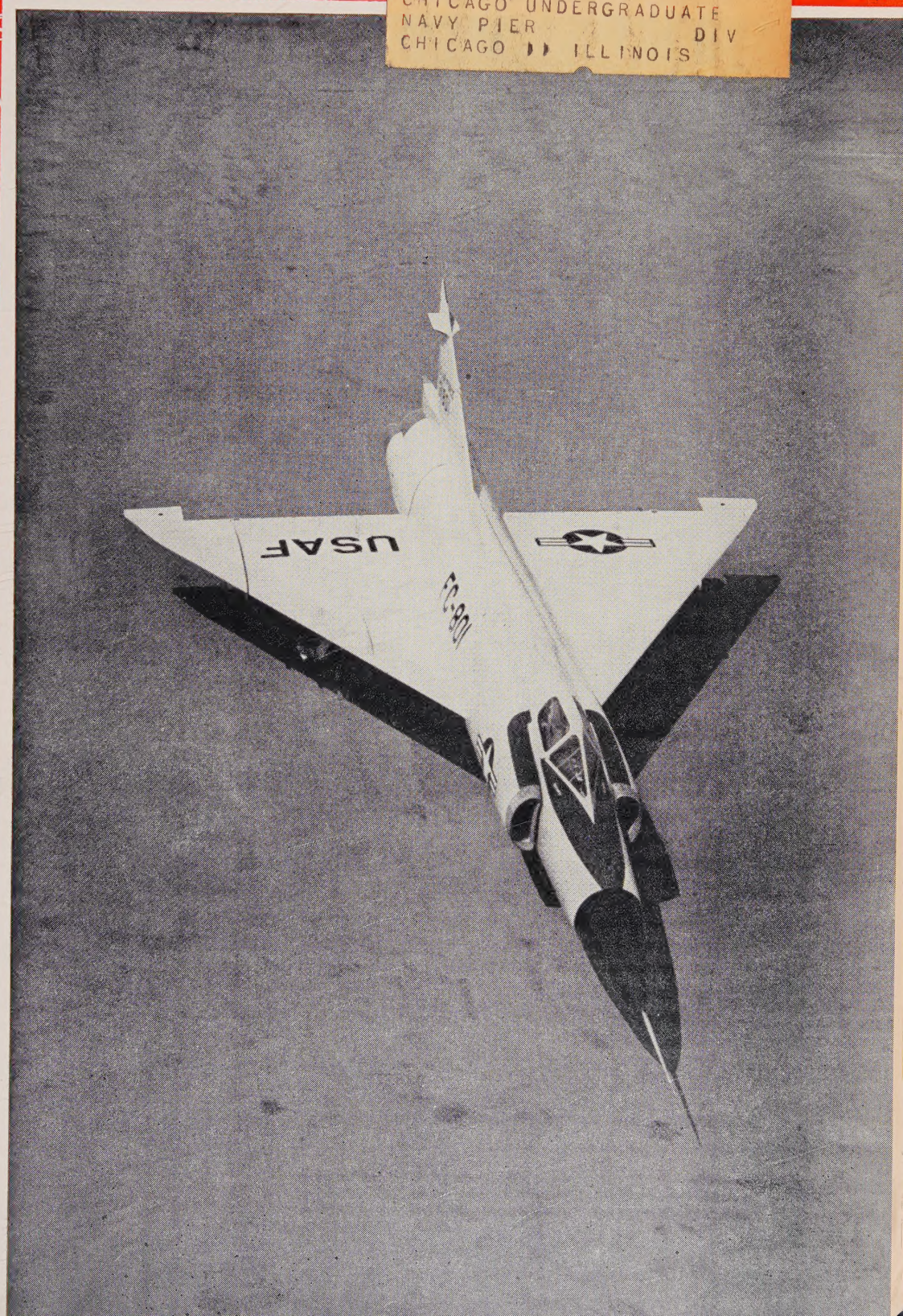
Skyways

Flight Operation
•
Business
Military
Commercia



of
Flying

•

bout Crew and
er Insurance?

•

Operations
Table:
Requirements of
Business Aircraft

ABER 1955 50c

Salute to the Paris

Early in June 1955 the twin-jet, four-place executive airplane PARIS, built by Morane-Saulnier of France with the type designation MS 760, started a demonstration tour of the United States and Canada under the sponsorship of the Beech Aircraft Corporation.

In ninety days it carried a total of 1820 people, not including the pilots. It made 724 demonstration flights from a total of 38 different airports.

It never required a revision of schedule or cancellation of a flight, in spite of an itinerary that was planned sixty days in advance.

Its record of maintenance shows that less than 0.85 man-hours of maintenance time was required per hour of flight time for this 410 miles-per-hour airplane.

It never required a battery cart for starting the two jet engines, or even an overnight battery charge.

The reaction of skilled jet pilots to both its flight and landing characteristics has been uniformly one of enthusiasm and pleasure. One top-level jet expert expressed it briefly, "Goshalmighty, *what* a Doll!"

BEECHCRAFT salutes the Morane-Saulnier designers and constructors for an outstanding achievement and a milestone in aeronautical progress – the MS 760 "PARIS".

This is the route of the "Paris" on Beechcraft's ninety-day nation-wide demonstration tour.

Beech Aircraft Corporation
Wichita, Kansas, U. S. A.

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

Look to the team that **takes care** of the busiest landing gear **and the "flyingest" planes)** in America!

LAST year America's civil aircraft made a record-breaking total of over *17 million* take-offs and landings.

Many of these planes were able to maintain their important on-time schedules, avoid costly delays, thanks to an unbeatable team of fixed-base and airport-service operators supplied by us with a complete line of top-quality replacement parts.

When the time came for overhaul or a replacement – these service operators were Johnny-On-The-Spot with time-proved Goodyear landing gear equipment, which is first choice of so many aircraft manufacturers as original equipment.

The fact that these dealers carry Goodyear Aviation Products is a good indicator of the top quality of all the parts and accessories they stock in order to keep America's civil air fleet the "flyingest" in the world.

We are proud that many of these dealers are supplied by us with the complete line of quality products they stock to assure you "on-time" schedules wherever you fly!

AIR ASSOCIATES, INC. *Atlanta, Ga.—Chicago, Ill. Dallas, Tex.—Glendale, Cal.—Miami, Fla.—Teterboro, N. J.*

AIR-PARTS INTERNATIONAL *Glendale, Cal.—New York, N.Y. San Francisco, Cal.—Washington, D. C.*

THE DON HORN COMPANY
353 Madison Ave., Memphis, Tenn.

GENERAL AIRCRAFT SUPPLY CORPORATION
City Airport, Detroit 13, Michigan

GENERAL AVIATION SUPPLY COMPANY
St. Louis, Mo.—Houston, Tex.—Oklahoma City, Okla.

STANDARD AIRCRAFT EQUIPMENT COMPANY
P. O. Box 271, Mineola, Long Island, N. Y.

STANDARD PRODUCTS, INC.
Wichita, Kans.—Tulsa, Okla.—Kansas City, Kans.

VAN DUSEN AIRCRAFT SUPPLIES *Minneapolis, Minn. Boston, Mass.—Washington, D. C.—Teterboro, N. J.*

SKYWAYS is published by the Henry Publishing Co., 50 Emmett Street, Bristol, Conn. Accepted as controlled circulation publication at Bristol, Conn.

Straight mineral aircraft engine oil for *both* radial and horizontally-opposed engines used in commercial service.

New!★

Gulf Aircraft Engine Oil proved 5 ways better!

1. Improves internal engine cleanliness
2. Minimizes sludge and oil inlet screen deposits
3. Lowers rate of parts replacement due to wear
4. Low pour-point for ease of starting even under severe winter temperatures
5. Increases periods between engine overhauls

FROM THE GULF LABORATORIES comes a new aircraft engine oil of *proved superiority*. New Gulf Aircraft Engine Oil has been extensively flight service tested in all types of air-cooled engines by private operators, executive fleets and airlines.

These operators report cleaner oil inlet screens, remarkable freedom from piston ring and valve sticking and reduced rockerbox coking.

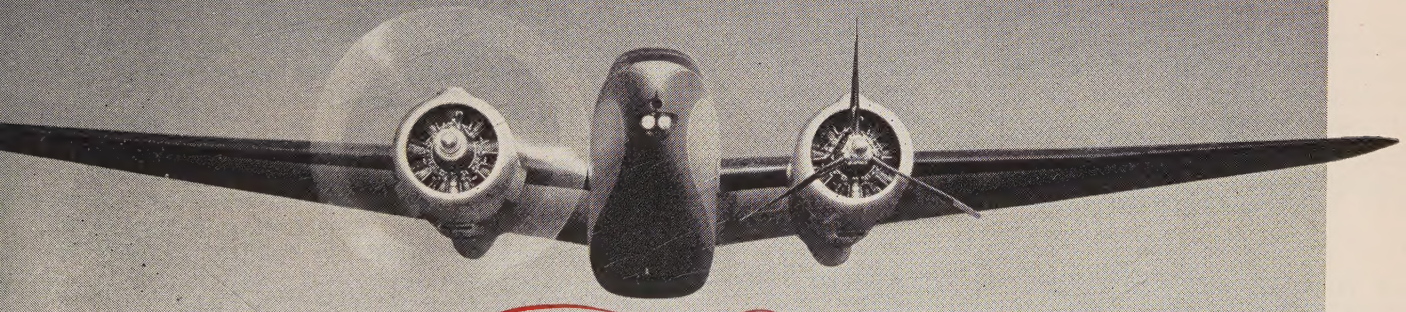
It all adds up to cleaner engines and less frequent engine overhauls. So the next time your plane is serviced—make it new Gulf Aircraft Engine Oil.

GULF
AVIATION PRODUCTS

Gulf Oil Corporation
Gulf Refining Company

more performance in reserve

...than any other executive airliner



Learstar

LS-5

LEAR, INCORPORATED, AIRCRAFT ENGINEERING DIVISION, SANTA MONICA, CALIFORNIA • THE LEARSTAR IS A MODIFICATION OF THE FAMOUS LOCKHEED LODESTAR

SPECIAL NEWSLETTER ON THE NEW WILCOX "CANARI"

First announcement of new space-saving, weight-reducing, airborne electronics system developed by Wilcox. Of special interest to aviation industry management and engineering personnel.

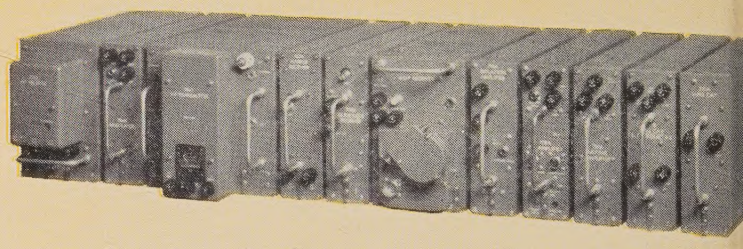
WHAT'S THE CANARI? It's the new Wilcox Communications and Navigation Airborne Radio Instrumentation (CANARI) System. The CANARI is a "package" system, made up of basic navigational and communications devices used on modern aircraft...in one system.

Each element is completely compatible with all other elements. Weight and size are reduced. How much? Read on! Modern, miniature components and new circuit design techniques, packaging and fabrication are used. And...at no sacrifice to performance, reliability and ease of maintenance.

THE SITUATION NOW IS THIS: Present assemblies are individual units. Each is self-sufficient. Each has its own shockmount, dynamotor power supply, audio amplifying circuits. Each is different size, shape. Each adds to total weight of airframe.

WILCOX BELIEVED THIS WAS WASTEFUL! Wilcox knew that size, weight and compatibility problems were severe enough on propeller-driven aircraft...shuddered to think of magnified problems on turbo-props and turbo-jets. SO WILCOX DID SOMETHING ABOUT IT! The result--The CANARI System.

UP TO FIVE HUNDRED POUNDS OF EQUIPMENT ELIMINATED! Let's compare the CANARI with typical installation using separate units. The CANARI cuts space needs more than half. The CANARI weighs one-third as much. About 200 pounds can be saved on minimum, basic CANARI system. BUT...a big but...a typical airline aircraft--where nearly all equipment is installed in duplicate--could



save up to five hundred pounds with the CANARI! Five hundred pounds for added passengers or fuel...that's in addition to enough space saved to install a full, dual CANARI in the area normally used for unduplicated, conventional system.

THE CANARI is assembled on one, custom-fitted shockmount. One junction box serves whole system. Junction box may be factory wired. You can get one package ready to mount with just three simple connections to make. All assemblies are same height. Width varies, but in definite fractions of ATR width. Depth uniform.

PERFORATED EQUIPMENT COVERS are used throughout. This steps up convection air circulation. Also, new heat-dissipating tube shield is used in conjunction with ARINC, airline-approved, miniature tubes. Sealed type components are used throughout.

SO, NOW IT'S HERE! The CANARI saves space, saves weight, saves time, saves money, makes money in any aircraft in which it is installed!

WILCOX ELECTRIC COMPANY
Fourteenth and Chestnut • Kansas City 27, Missouri, U.S.A.

RUSH ME detailed information on the Wilcox CANARI!

Name _____

Position _____

Company _____

Address _____

City _____ Zone _____ State _____

YOU CAN'T AFFORD TO TURN THIS PAGE WITHOUT TEARING OUT AND MAILING THE COUPON NOW! Or write, wire or phone to the address below . . . right away!

wilcox
ELECTRIC COMPANY, INC.
Fourteenth and Chestnut
Kansas City 27, Missouri, U. S. A.
Phone: BEnton 0700

now hear this . . .

PERSONNEL

Dr. Theodore von Karman, senior scientific advisor on aeronautics to NATO and USAF, was named a director of Gruen Precision Laboratories, Inc., newly formed subsidiary of Gruen Watch Co. Gruen Precision Labs was organized to engage in engineering and development of precision products for national defense.

Dr. Franklin Kingston Moore, formerly a consultant to the Supersonic Propeller Division, Lewis Propulsion Laboratory of NACA, Cleveland, was appointed head of the Aerodynamic Research Department of Cornell Aeronautical Lab.

Donald V. Sarbach has been appointed research director of Hewitt-Robins, Inc. Mr. Sarbach formerly was technical manager for development of new industrial products, B. F. Goodrich Company.

Lee S. Johnson was named senior assistant general manager of Sikorsky Aircraft Division of United Aircraft Corp. Mr. Johnson is a veteran of 26 years in United's Pratt & Whitney Aircraft division.

Lovell Lawrence, Jr. has been appointed general supervisor of missile design for Missile Branch of Chrysler Corp. Formerly head of the Powerplant Design Dept., Mr. Lawrence is succeeded in that position by **Alfred Africano.**

Vice Admiral Charles B. Monsen, USN (ret.) has been engaged by General Dynamics Corp. to serve as a consultant. Adm. Monsen is the inventor of the Monsen lung, submarine escape device.

T. L. Boyd has been named by American Airlines to succeed Lawrence G. Fritz as vice president-Flight. Mr. Fritz retired for reasons of health. Mr. Boyd has been Mr. Fritz' assistant.

Edward J. Felesina was named public relations manager of Federal Telecommunications Labs, research division of IT&T.

Arthur Settel was appointed director of public relations for KLM Royal Dutch Airlines in the United States.

James M. Archer has been elected assistant comptroller of Fairchild Engine and Airplane Corp.

Roger Lewis has been elected an executive vice president of Pan American World Airways. He is in charge of Pan American's development and defense projects. **Capt. Hamilton Smith,** veteran Pan Am pilot and operations official, has become head of the airline's corps of experts assisting Pakistan to modernize its airline system. Capt. Smith is succeeding **Capt. Henry C. Kristofferson** who is resuming duties with Pan American in San Francisco.

Vernon G. Crudge, aviation consultant of New York City, was retained by Boeing Airplane Co., as a special consultant.

Dan S. Tilden, former service manager of Eclipse-Pioneer division of Bendix Aviation, has been appointed commercial sales manager. **Douglas Hembrough** has been named assistant commercial sales manager, and **Harold L. Peck** has been appointed service manager to succeed Mr. Tilden. **George G. Hyde** was appointed patent attorney for Pioneer-Central division of Bendix, and **Thomas R. Bartless** was named sales manager of the York division. **Forrest L. Dunbar** has been named director of industrial relations of Bendix Products division, and **F. C. Weyburne** has been named general manager of Bendix Aviation's Skinner div.

R. V. Lynch, formerly assistant sales and service manager of Chance Vought Aircraft, recently was promoted to the post of sales and service manager.

Robert O. Vaughan was appointed vice president of National Aircraft Corp. and will be in charge of the expansion program of Marvelco Electronics division of National Aircraft.

HONORS

Stanlislaw Krzyczkowski, technical director of IATA, was voted a citation by the Flight Safety Foundation Industry Advisory Committee.

Willis C. Brown, staff specialist for aviation education with the U.S. Office of Education, was the recipient of the 1955 Frank G. Brewer Trophy, the nation's highest award in the field of youth aviation education and training.

Charles S. Weaver, vice president for atomic power activities of Westinghouse Electric Corp., was presented the annual National Transportation Award. Mr. Weaver was given the award for his work in directing the development and construction of the nuclear-powered submarine, USS Nautilus.

Raymond L. Bisplinghoff, professor of aeronautical engineering at MIT, has been invited by IAS to deliver the Wright Brothers Lecture this year. The lecture is scheduled for December 17, in the auditorium of the U.S. Chamber of Commerce Building, Washington, D.C.

Alexander Kartveli, vice president and chief engineer of Republic Aviation, received an honorary doctor of engineering degree from the Polytechnic Institute of Brooklyn.

AERO CALENDAR

Dec. 2-3—Eighth Annual Aviation Conference and Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6, 7—Professional Racing Pilots' Association Convention. Carter Hotel, Cleveland, Ohio.

Dec. 12-17—Nuclear Congress and Atomic Exposition, sponsored by Engineers Joint Council, Cleveland, Ohio.

Dec. 15, 16, 17—U.S. National Committee and International Radio Scientific Union fall meeting, University of Florida, Gainesville, Fla.

Dec. 17—Nineteenth Wright Brothers Lecture, U.S. Chamber of Commerce auditorium, Washington, D.C.

Jan. 9, 10—Reliability and Quality Control symposium—electronics, sponsored by IRE, Hotel Statler, Washington, D.C.

Jan. 9-13—SAE Annual Meeting, Sheraton-Cadillac Hotel and Statler Hotel, Detroit, Mich.

Jan. 19-21—National Simulation Conference, sponsored by Dallas and Fort Worth Chapters of IRE, Dallas, Tex.

HERE ARE FACTS WHY

DME IS A SAFE INVESTMENT

There has been so much smoke and confusion about future navigation systems that the airspace is apt to be filled with ideas instead of navigation signals.

The situation has understandably bewildered aircraft owners and given them cause to wait and see—even though they realize that a navigation system which gives them both distance (rho) and bearing (theta) would greatly simplify their cross-country navigation and IFR operations.

These facts are now clear and cannot be disputed:

1. The VOR/DME system is fully developed providing highly dependable and extensive service. Congress has appropriated funds for continuation of this system. There are 231 DME's in operation now and 175 more on site ready to be turned on when additional funds become available.

2. CAA, in its 5 year navigation program proposal just made public, calls for 383 more VOR's and 648 additional DME's.

3. The Air Coordinating Committee, whose recommendations generally set National Air Policy, has assured DME operation for years to come. ANDB's decision earlier this year was not to *adopt* Tacan, merely to investigate its possible use in the Common System.

4. Tacan is still in a very experimental stage as a common system element. In its present form it is strictly a tactical navigation equipment. Conservative estimates say that four years would be required to re-engineer ground equipment for satisfactory civil airway use. No satisfactory design for airline or small aircraft Tacan has been demonstrated. Tacan does not provide voice communication or ILS approaches and these functions would require separate equipment if Tacan were adopted in its present form.

5. Implementation of such a system on the airways to the same level of operation as VOR/DME today would require eight to ten years. This has been confirmed by CAA, ANDB and IATA.

6. There is no argument in any quarter as to the reliability, accuracy, or dependability of present-day DME. It is recognized by all as being equally accurate as any other distance measuring system. It has been completely "de-bugged" and backed by a nation-wide service.

7. New, authorized DME approach procedures are already being published in the Airman's Guide and are being incorporated in the Jeppesen Manual as fast as released. These DME approaches permit lower minimums in many cases where terrain clearance has been a problem, reduce to a minimum let-down procedures, greatly expedite instrument operations. Australia has made DME mandatory for airline operations and pilots report DME far more accurate than older systems of using cross-bearings and even fan markers for position indication.

8. The conclusion which can be drawn by any clear-thinking aircraft user is that:

- **No other system can possibly supersede DME for a decade.**
- **VOR/DME provides *today* and in the years to come a highly superior navigation system with continuous position indication without estimate, calculation or guess-work.**
- **Highly reliable, light-weight airborne DME is available today.**
- **Anyone installing DME in his aircraft can be assured beyond any question of doubt of getting a full span of usefulness out of his DME with no danger of rapid obsolescence.**

If you would like more information on Narco Model UDI-1A DME see your nearest Narco distributor, factory-approved service center or write to National Aeronautical Corp., Ambler, Pa.

narco
NATIONAL AERONAUTICAL CORPORATION
Ambler · Pennsylvania

In mythology the Centaur combined manpower with horsepower, neither being very dependable; but SPARTAN has the manpower to give you the best in horsepower.

Every day at SPARTAN, aircraft engines arrive from all over the nation with more than 250 being processed every month. From disasssembly and degreasing through overhaul, inspection and final checkout in the test cells, your engine receives the most careful attention.

Many of our customers have a second set of engines kept in readiness so they can fly in for a fast engine change. We would like for you to come in for a tour of our plant — at any time.

Ask for our new brochure which illustrates and describes our many facilities. A request on your company letterhead will bring a copy by return mail.

SPARTAN AIRCRAFT COMPANY

AVIATION SERVICE DIVISION

MUNICIPAL AIRPORT TULSA, OKLAHOMA

industry notes . . .

■ The USAF's newest all-weather interceptor, the wasp-waist F-102A (see cover), is coming off production lines at the San Diego plant of the Convair Division of General Dynamics, in increasing numbers. The delta-wing jets are due to become familiar sights in the skies over American cities in 1956 as the Air Defense Command begins to activate F-102A squadrons. A combat proficiency trainer version, designated TF-102A, is also in production at Convair.

■ The Board of Directors of Pan American World Airways recently approved the purchase of 45 American-built jet transports, 20 of which will be Boeing 707 Jet *Stratoliners*, and 25 will be Douglas jet *Clippers* (DC-8). The 707 will carry from 80 to 130 passengers at cruising speed of over 550 mph at an operational altitude of 25,000 to 40,000 ft. The Douglas DC-8 will be a sweptwing transport capable of carrying from 108 to 131 passengers at a 550-mph cruise.

■ The familiar dashboard cigarette lighter in your car has invaded the realm of electronic warfare as a built-in part of the new ground-based USAF air defense system. Engineers report that an operator, scanning the system's glowing indicator radarscopes for hours in semi-darkness, could be temporarily blinded by the flare of a match or pocket lighter when lighting a cigarette. Therefore, the built-in lighter was ordered as part of a human engineering program, to keep the operator as undistracted as possible. The electronic equipment itself is being built by General Electric.

■ British European Airways presently is in the process of negotiating with Vickers-Armstrongs Ltd. for a fleet of Vickers 900 *Vanguard* airliners for delivery in 1959/60. The *Vanguard* will be a 93-passenger transport powered by four Rolls-Royce RB 109 turboprop engines. Design cruising speed will be 425 mph. The fleet of *Vanguards* will be operated over BEA's high-density routes. On routes not requiring aircraft of the passenger capacity of the *Vanguard*, BEA is planning to use *Viscount-Majors* now on order for delivery next year.

■ Republic Aviation has completed negotiations with Beech Aircraft for the manufacture of jettisonable fuel tanks for the USAF F-84F and the RF-84F jet fighters. In addition to the fuel tanks, Beech also is manufacturing flaps and ailerons for the *Thunderstreak* and its photo reconnaissance counterpart, the *Thunderflash*.

■ Eight airlines have signed an agreement with New York Airways to provide their passengers with connecting helicopter service between N. Y. International Airport, LaGuardia and Newark Airports. These airlines are TWA, Air France, BOAC, KLM, Sabena, SAS and Swissair. Under the agreement, all international transit passengers carried by the airlines will pay no extra charge for copter service between the three airports. International passengers originating or terminating at N. Y. International will pay $3, plus taxes, for the flight between LaGuardia and N. Y. International, and $5 between Newark and N. Y. International. New York Airways has ordered Sikorsky S-58's for operation next year.

■ An emergency power unit, developed and produced by Marquardt Aircraft in cooperation with Chance Vought, is being installed on Chance Vought XF8U-1, Navy day fighters. The ram-air emergency power package supplies both electrical and hydraulic power in sufficient quantities to maintain flight control and communications through all speeds. It has been developed as a "drop-out" type in which a trigger pushes the machine out into the air stream and the air turbine begins operating immediately to drive the hydraulic pump and electrical generator. The complete power package weighs less than 50 lbs. installed. If the pilot is faced with an in-flight emergency, such as a flame-out of the main engine, he can initiate aerial restarts within seconds with the Marquardt power package. Other units have been developed for use on jet cargo and bomber aircraft.

■ The USAF recently placed "the biggest order yet" for the new Lockheed F-104A jet fighter, a prototype of which currently is flying at Edwards Air Force Base, Calif. According to Lockheed officials, the order in its entirety amounts to more than $100,000,000, including spare parts. First production units are now moving along assembly lines at Lockheed's California Division.

■ The Army Aviation School at Camp Rucker, Ala., has announced it's in the market for helicopter instructors and is offering a minimum salary of $6,390 per year and a maximum salary of $7,465. Applicants must hold currently valid CAA license with instructor's rating for either rotary wing or fixed wing aircraft, and must show a minimum of 500 hours as first pilot, helicopter. There is a minimum age limit of 18 but no maximum age limit. So if you want to teach student officer pilots how to fly the whirlybirds and can meet the license requirements, wipe the peach fuzz off your face or tuck your long green beard into your shirt and address your inquiries to the Board of U.S. Civil Service Examiners, Army Aviation Center, Camp Rucker, Ala.

DECEMBER, 1955

Skyways

The Magazine of Flight Operations

COVER: Convair S-102A Jet Interceptor

FOUNDED BY J. FRED HENRY, 1942
EDITOR & PUBLISHER
Mrs. J. Fred Henry

DIR. OF PUBLIC RELATIONS
ADVERTISING DIR.
Clarence Cisin

READER SERVICE MGR.
CIRCULATION MGR.
A. L. Verschoor

MANAGING EDITOR
D. N. Ahnstrom

ART DIRECTOR
Anita L. Nazaruk

BUSINESS & PROD. MGR.
Stanley M. Cook

WASHINGTON CORRESPONDENT
Albert D. Hughes

CONTRIBUTING EDITORS:
Karl Hess—Fuels & Oils
Herbert O. Fisher—Flight Evaluations

SALES OFFICES:

ADVERTISING OFFICE, 122 E. 42nd St., New York 17, N.Y.
Tel. MU 2-9138

SOUTH EAST—Ray Rickles, Chamber of Commerce Bldg., Miami 32, Fla.
Tel. 9-1495

MIDWEST—C. T. Engdall, 154 East Erie St., Chicago 11, Ill.
Tel. Delaware 7-3605

WEST COAST—Joseph W. Harbison, 6535 Wilshire Boulevard, Los Angeles 48, Calif.
Tel. OLive 3-3223

SKYWAYS is the authorized publication of the National Business Aircraft Association.

Member Business Publications Audit of Circulation, Inc.

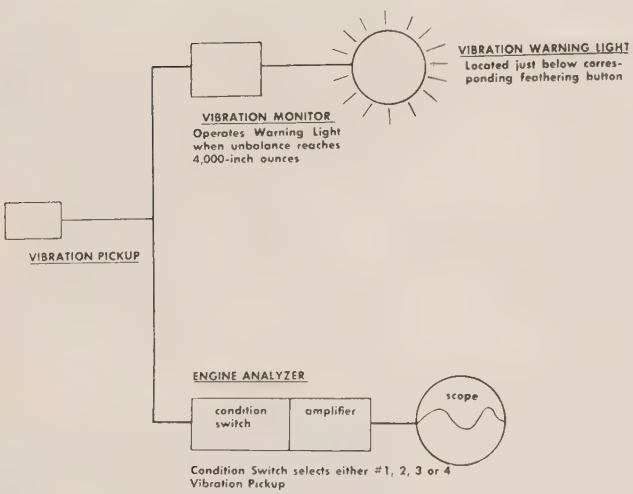
VOLUME 14, NUMBER 12

SKYWAYS is published monthly by Henry Publishing Co., 122 East 42nd St., New York, N.Y. Printed in the U. S. A. Single copy; 50c. Subscription Prices. U. S., Possessions, Canada and Pan Am. Union, $9.00 for 3 years, $7.00 for 2 years, $4.00 for 1 year; all other countries add $1.50 per year for postage. Please give title, position and company connection when subscribing. Six weeks required for address changes (give both old and new). Manuscripts, drawings, other material must be accompanied by stamped, self-addressed envelope. SKYWAYS is not responsible for unsolicited materials. Accepted as controlled circulation publication at Bristol, Conn.

THE ART OF SMOOTH FLYING

by Capt. Chuck Banfe

Pan American World Airways



In the main, vibration is more than an indication of wear and inefficiency; it also produces physical and mental fatigue to the passengers and crew, contributes to metal fatigue, and in the higher registers, foretells engine, propeller, or airframe failure.

There are three basic causes of vibration in aircraft. One is from the airframe, the second is from the propellers, and the third, from an engine. It might run in frequency and amplitude from a slight tremble to a point where, in one Boeing *Stratocruiser*, the dinner trays jumped from the galley counter in the tail compartment and splattered over the floor.

Vibration is good troubleshooter if properly interpreted. It usually precedes an engine failure. It always accompanies propeller unbalance and increases with the unbalance until the propeller leaves the engine.

It was because of vibration problems that Pan American World Airways began a study and from that work came several vibration indicators.

On the present Boeing *Stratocruisers*, Pan American built an electrical circuit which started at the propeller hub, went through an amplifier and then to the engine analyzer at the Flight Engineer's station. Its primary job was to determine *which* propeller or engine was setting up the excessive vibration. It did not indicate the amplitude of the frequency.

In parallel with this engine analyzer vibration system a second circuit was established using the same pickup installed on the nose section of each engine. Voltage from each of the four pickups is applied to a vibration warning system after passing through its own amplifier. Called a propeller unbalance warning system, it was designed to instantaneously detect dangerous unbalance and operate a warning light which identifies the faulty propeller. This second system, however, operated only when propeller unbalance, measured on a lateral plane, reached 4,000-inch ounces.

The accompanying schematic briefly outlines the circuitry for one of the four systems.

These circuits were designed in such a way that a failure in the engine analyzer would not affect the operation of the vibration warning monitor, or v.v.

Pan American was concerned with high-frequency and high-amplitude vibrations which could be used as warnings in flight. The engine analyzer system and the propeller unbalance warning system both warned the Flight Engineer *when* vibration had reached an above-safe level but they did *not* cover lesser vibrations in the 500 to 4000 inch-ounces.

Two Pacific Division engineers, Doc Savage in Flight and Gene Grindle in Liaison, developed a device to cover all ranges of frequency and amplitude from 500 to 10,000 cycles per minute.

They used the vibrating reed principle as the fundamental basis of its construction. This reed vibrometer is a thin cold steel reed so arranged that a solid contact is always maintained at the fulcrum point. Rotation of a thumb screw extends or retracts the free end of the reed with a resulting decrease or increase of the natural frequency of the reed.

The instrument is mounted on the stanchion post at the left of the Flight Engineer's table. To determine a vibration frequency, the engineer turns the thumb screw until the reed vibrates at maximum amplitude. The frequency of the airplane vibration is then indicated by the position of the tip of the reed to the graduated scale on the instrument. Amplitude is indicated by the total deflection of the reed from each side of the center. Amplitudes between even-thousands of an inch are easily interpolated.

As the reed is moved through its adjustable range, all frequencies present in the airplane structure will be apparent when the reed attains resonance with any of the component frequencies. (An example of this is when you sing a note in a clear voice in front of a piano, the string nearest in tune [resonance] gives an audible response. Caruso broke champagne glasses by singing a note which was in resonance with the glass.) In this way the frequencies can be determined separately, while all other frequencies present are tuned out.

The vibrometer, of course, can be used for troubleshooting any rotating component other than propellers, and the vibration source is identified by relating the vibration frequency to a component on the airplane operating at the same frequency, *i.e.*, the engine RPM is known by the tachometer reading; the rotating or reciprocating parts of the engine operate at known ratios to the crankshaft. Cylinders fire at half crankshaft speed, therefore, a dead cylinder would unbalance the engine at that frequency and the vibrometer would show excessive vibration at half crankshaft speed.

Propeller vibration is always identified by multiplying the crankshaft speed by the propeller gear reduction ratio

r 1^P (propeller speed) vibration and times the number f blades for 3^P or 4^P (for blade speed on 3-bladed or -bladed propellers respectively). Blade frequency is sually caused by air slugs impinging on the side of the uselage and very little can be done to reduce this type f vibration.

By mounting the vibrometer on the basic aircraft struc-ure, harmonics or sub-harmonics are no problem and dentification of the vibration source is quite positive.

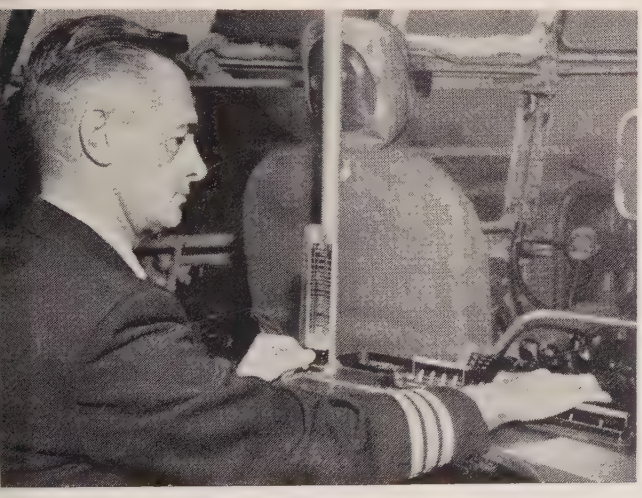
Pan American installed the vibrometers on its Pacific leet more than a year ago and immediately Flight Engi-neers began to experiment with the resonant frequencies et up.

Within a short period of time it was found that the by-products of the reed vibrometer were as important as its intended job. Here, for the first time, was a means of quantitative measurement of airplane vibration and, n addition to isolating the vibration source, it provided mplitude indications which heretofore had been deter-nined only by the seat-of-the-pants. Obviously, such seat-of-the-pants measurements were of little value.

The Flight Engineers discovered that by varying all four propellers in high-vibration conditions, by a few RPM, the vibration *and* noise level in the aircraft dropped sharply.

It was propeller phasing, later developed, which caused such letters as the following:

"I want to tell you how much the smoothness of the engines in flight impressed me. Not only myself but several other passengers commented on the smoothness and quiet of the operation. I think you all deserve con-



VIBROMETER *is mounted on stanchion post to the left of Flight Engineer's table. Here Flight Engineer Rod Proctor phases propellers*

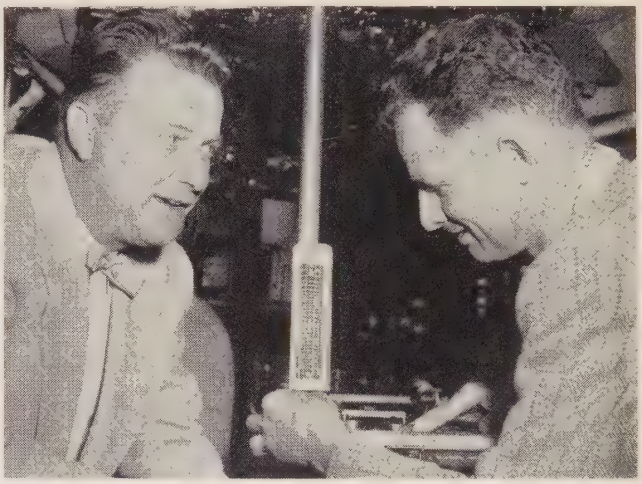
gratulations on a major achievement!"

Propeller phasing, perhaps better called propeller bal-ancing, is predicated on the fact that one of any four blades on each of the four propellers is infinitesimally heavier than the others. It is possible, by arranging these "heavy" blades on each propeller in a certain relation-ship to each other, to cancel out the vibration effect set up by the propellers.

Suppose that Number one blade were the "heavy" one on each engine. And suppose that as the four propellers turned in flight, the Number one blade was always straight up on all four propellers at the same instant. That would produce a certain amount of vibration. But if the relative position of each Number one blade to each other Number one blade could be changed, the vibration would be lessened.

That is what the Flight Engineer does when the *Stratocruiser* reaches cruising altitude. He uses Number one propeller as the master. Then, one at a time, each of the other three engines is allowed to gain or lose one complete revolution. By watching the vibrometer, the Flight Engineer can stop that propeller at the least-vibration point. He repeats this with the two remaining propellers until a minimum vibration level is reached. By this propeller phasing, Pan American estimates it can reduce vibration level to one-fifth!

While in Honolulu, Doc Savage had a spare vibrometer. A non-scheduled airline had so much vibration with its Short flying boats that they weren't sure they could operate them. By borrowing the vibrometer, however,

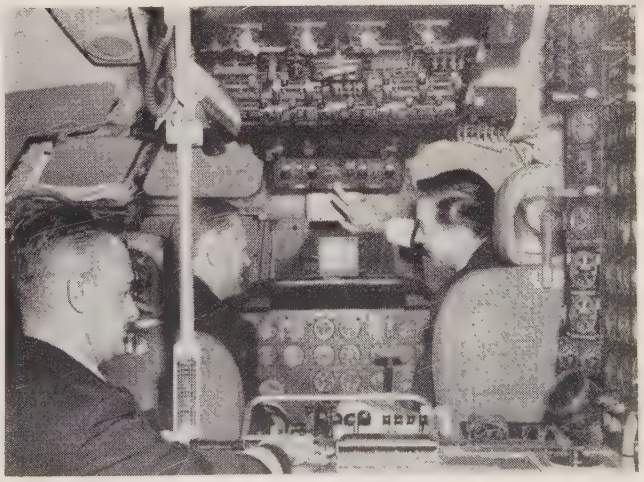


CREDIT *for development of reed vibrometer goes to Gene Grindle (l.) and Doc Savage shown here adjusting reed length of vibrometer*

they were able to ascertain the vibration cause immediately and correct it.

Perhaps more remarkable is the fact that the reed vibrometer can be used in executive aircraft with one or more engines! It can accomplish the same job as on a Boeing *Stratocruiser* and can be mounted anywhere in the aircraft (where the manufacturer can give vibration settings—normal and maximum). The cost is about $25.00. Cheap enough at twice the price! Then the pilot can monitor *Engine RPM* or, using propeller reduction

(*Continued on page* 34)



FLIGHT ENGINEER *Proctor checks prop unbalance on Stratocruiser. Capt. Amundsen watches author test prop unbalance warning system*

LOST NATION
A Business Plane Airport

Heads-up operator and air-minded industrialists improve Cleveland field through unique financing

More than one executive-aircraft pilot has done a fast double-take after a first glance at an airport some 20 miles east of downtown Cleveland. The cause of surprise is a new 5,000′ x 100′ paved runway, complete with TVOR facilities and a CAA instrument approach pattern, at Lost Nation Airport, a privately owned field at Willoughby, Ohio.

Transients who land at the field soon learn that there are more surprises than that at Lost Nation. For example, ground-air communications include a Unicom system and two standby transmitters for emergency use; standard weather teletype, covering the country west to Denver, is in operation; and the field boasts two new storage hangars. In addition, executive-aircraft parts, maintenance and radio repair facilities are more complete than any within 200 miles.

Less than 10 years ago, Lost Nation was just another sod field, with a handful of students flying *Cubs* and Taylorcrafts. Then Bill McNeely, president of General Aviation, Inc., the base operator, took over, and began a series of improvements which have made business-flying history and won the applause of company pilots throughout the Midwest.

The Lost Nation story hinged on two important forces: McNeely's day-and-night efforts to build the field's business-flying services, and the strong cooperation of aviation-minded industries in the greater Cleveland area. These companies gave financial backing to the runway project in a plan which has brought benefits to everyone concerned.

A few years ago Cleveland-Hopkins Airport, the municipal field on Cleveland's west side, was the only field available for all-weather operation of executive aircraft. This brought problems for executives. Most well-established Cleveland industry is located on the east side, and most executives live in eastern suburbs. Getting to Hopkins is almost an hour's trip, and in rush-hour traffic it's a nerve-wracking experience. Lost Nation is about 30 minutes from the east side. In addition, Hopkins is primarily an airline field. The scheduled carriers contribute most of the field's income, serve a greater number of Clevelanders than executive craft and, of course, merit first consideration in airport planning. With municipal management at Hopkins governed by these considerations, busy executives had a double reason for wanting a good east-side field. When McNeely worked out plans for giving them one, they were ready and eager to listen.

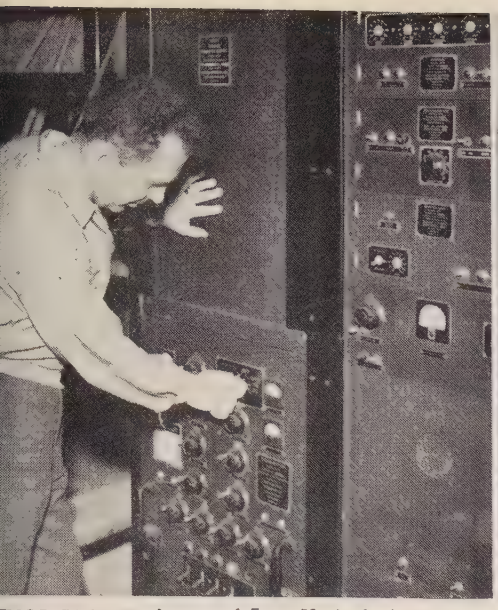
Soon after he took over Lost Nation operations, Bill McNeely realized that a good hard-surface runway was a necessary part of the airport's growth. He didn't know how it would happen, but he felt sure that someday the way to get such a runway would be found. He had been a commercial pilot for the previous Lost Nation management before joining the Naval Air Transport Service during the war; and his varied experience taught him that ingenuity can overcome many obstacles.

If nothing else, this hard-hitting young executive has proved he's ingenious. One of his early improvements at Lost Nation was to install lighting on the main landing strip, using Mason jars and home-made sheet metal cones for the fixtures. The local electric power representatives had warned him the rig would never work—line loss would be too great—but the Lost Nation crew made it work anyway.

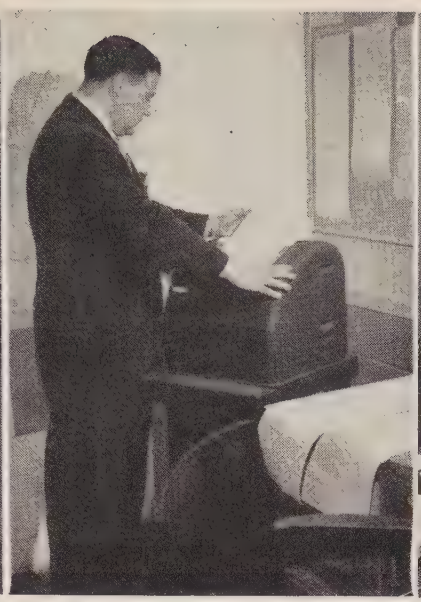
This same inventiveness was put to work on the runway idea. The first step was to draw up basic engineering plans. With these done, the next step was a large amount of grading work. One of the companies operating a business plane out of Lost Nation Airport was in the earth-moving business. McNeely talked with company officials and when he discovered the company was in need of a test area for new developments, an arrangement was worked out for them to test their equipment by moving earth at Lost Nation. Result—Lost Nation was saved a major part of the grading cost.

With work started toward a runway, McNeely began talking with officials of other important companies in the area. After lengthy discussions

DIAMOND ALKALI DC-3 *is just one of the business planes that home-base at Lost Nation*



TVOR FACILITY *is one of Lost Nation's features. Here, General Aviation pilot, Ted Kraus, checks the field's TVOR equipment. Field also employs Unicom; has one paved 5,000-foot runway*



GA PILOT *Dick Hall studies Lost Nation's weather teletype before take-off. Before General Aviation, Inc. took over the airport, it was just another sod field*

GENERAL AVIATION *president Bill McNeely is credited with being largely responsible for the Lost Nation Airport's success as field operated in the main for executive aircraft*

and a study of the problem by legal and tax counsel, McNeely and the group developed a plan. It works like this: the group of companies agreed to lease from Lost Nation the right to use a hard-surface runway, at a stated fee, for a 10-year period. On the strength of these agreements, Lost Nation was able to borrow some $170,000 from local banks, a sum which met the construction cost of the runway, plus bank interest. Each month the companies send in their payments (and, being lease expense, the amount is immediately chargeable by the companies as a business cost). Lost Nation receives the payments, as income, and uses the money to repay the loan and interest due. To match this income, which of course is taxable to the field, Lost Nation has regular amortization of the runway and financing cost-tax-offsetting charges which just equal the lease income.

The companies that agreed to participate in the plan included Diamond Alkali Co., which took a leading role in presenting the idea to the others; M. A. Hanna Company; Eaton Manufacturing Co.; Lubrizol Corporation; and Thompson Products. All are among Cleveland's "blue-chip" industries, and all were interested in air transportation as the best answer to a vital executive need. Since the original plans were made, Pickands Mather & Co. has joined the group, adding additional strength to the program.

With the financing squared away, McNeely had to deliver a runway—and he did. Wherever possible, quality was upgraded from the original specifications and costs were pared from the original estimates. One saving of several thousand dollars was made possible when McNeely found a high-grade gravel pit which had been ordered to close its operations within 30 days. By calling on every available truck in the county, McNeely multiplied production at the pit and was able to get good foundation and aggregate material at a fraction of ordinary cost.

By late last year, the runway was in operation, along with a string of other improvements. Including the new additions made by Lost Nation itself during the past few years, they were a new administration building with comfortable furnishings and a good waiting-room view of the field, a new taxi apron next to the passengers' lounge and adjacent to a circular auto drive for unloading baggage, a new gravel-topped parking area for over 100 cars, extensive landscaping, good-looking signs, and other marks of a going business that is a credit to a community.

When runway plans first began to develop, Lost Nation added a new 100′ by 160′ steel hangar; and shortly thereafter work was started on a second one. This later hangar, built on ground leased to Diamond Alkali, was built by that company and Pickands Mather & Co. for their own use. It includes private shop facilities and headquarters for pilots of the two companies. While no further customer-owned hangars are in actual construction as yet, the plan appears to be a workable one, with definite benefits to the users, and others may possibly follow.

With a Cessna distributorship, General Aviation has long been the best terminal in northern Ohio for non-airlines parts and service. These facilities have been expanded by the addition of new equipment and by the installation of new tankage facilities. The field now offers standard 80, 91 and 100 octane fuel as well as major and minor engine work, Magneflux parts inspection, fuselage repairs, and radio work. The field is manned 24 hours a day, and offers rent-a-car service for transient visitors. A further "extra" at the field is a Link trainer which enables pilots to brush up on instrument techniques.

One of the concerns in McNeely's mind was his neighbors. What would they think of the airport's development and improvement. Many airports have come to be looked upon as nuisances, and McNeely wanted to build a constructive reputation for the field, not a negative one.

There have been some complaints, of course, and these have been carefully heard through. Twice, McNeely has held evening meetings of interested neighbors to talk over mutual problems. These meetings have been carefully reported in the local newspaper, with healthy results for all concerned. With the exception of one or two who may have been tempted to use the airport's growth as a political football and attract attention to a prospective local candidate, the neighbors are well pleased. They like the clean, well-tended way the field looks. They like the reduction in traffic, as compared with the immediate postwar days

(*Continued on page* 34)

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

DECEMBER 1955 *Sheraton-Cadillac Hotel, Detroit, Mich.*

Power Requirements of Future Business Aircraft

Moderator E. Tilson Peabody (*Dir., Air Transport Section, General Motors*) : "Our subject for this SKYWAYS' Round Table discussion emphasizes the growth factor of the engines powering current business planes. In any discussion involving the future we are inclined to skip over the obstacles of today and tomorrow and to exercise freedom of imagination in the unrestricted realm of 1965, 1990 and the year 2,000. But the future begins right now, for today is the tomorrow we worried about yesterday. I know we all are interested in the future for, in the words of Boss Kettering, that is where we are going to spend the rest of our lives. But before we get too far down the road, perhaps we should find out where we are now and where we would like to go.

"Aircraft primarily are designed and built around available or proposed powerplants. When built and tested, they often are found to have too much weight for the power or too little power for the weight. Then the operator increases the weight, adds drag and has to use additional power to run his equipment and accessories. This seems to me to be the general situation in business aircraft today. Therefore, our attention should be directed to the power-required *vs* the power-available in business aircraft.

"The performance of today's aircraft has been and is deteriorating due to increased weight, increased drag, and the increased power needed to operate accessories and equipment. One question, therefore, is, how can we maintain and increase the performance of today's business aircraft through more effective use of the horsepower available? Another question is, how long can we reasonably expect the supply of surplus engines and parts to last at the present and projected rate of use? And a third question, can we increase the power available by increasing the power output of today's engines?

"Gentlemen, getting into the first area of our discussion, I wonder if Hal Henning would give us a picture of where we are now relative to the increasing weight problem in today's aircraft."

Hal P. Henning (*Operations Mgr., Air Transport Section, General Motors*) : "Most of us are operating airplanes that are at least 20 years old in design, which means that in order to bring them up-to-date operationally we have to add equipment—for example, radio equipment to give us more channels so we can operate in congested areas under instrument conditions, combustion heaters to give our passengers more comfort, and many other items of that sort which

ROUND TABLE *in Detroit during NBAA Annual Meeting was attended by (left to right, standing) W. C. Jamouneau, Piper Aircraft; E. R. Jones, Van der Horst Corporation; George Meyers, Monsanto; Ralph Harmon, Cessna; John Gillespie, Airwork; Herb Bowie, Lycoming; (seated, left to right) E. W. Conlon, Fairchild Engine; Will Wiseman, Continental Motors; Joe Mashman, Bell Aircraft; W. L. Littleford, Bell Aircraft; George T. Pew, Aero Design & Engineering; E. Tilson Peabody, Air Transport Section, General Motors Corporation who served as moderator of the meeting; Hal Henning, also General Motors; Mike Murphy, The Ohio Oil Company; Blackie Martin, Steward-Davis; Art Kuhn, Pan American World Airways; and Bob Reed, Allison*

"INSTALLATION *of such items as antennas, loop housings, etc.," reported Pan American's Art Kuhn (second from right), "add drag, but modifications that are presently in the planning stages will reduce the items and make current horsepower more effective"*

"THE AIRCRAFT *most of us are operating," said Hal Henning (seated to Moderator Til Peabody's left), "are 20 years old in design, and to bring them up-to-date we must add equipment which means adding more weight and getting less performance"*

nave contributed to the weight-growth of the airplane. Each pound of weight we add to the aircraft requires more horsepower to pull it along. Therefore, when we add that weight, we know we are having to sacrifice something in performance or payload.

"Coincident with the adding of electronic equipment, we have had to increase the size and, therefore, the weight of the generators of our electrical systems. We have had to add new and more powerful inverters to give us at least marginally adequate electrical power. All of these additions of weight can be considered a reduction in available horsepower to take our passengers through a mile of airspace in a given length of time.

"These are some of the reasons we must give consideration to weight control, inasmuch as we are limited in the addition of horsepower."

Til Peabody: *"Let's consider how we have added to the drag of these aircraft and what can be done to correct the situation. Art Kuhn?"*

A. W. Kuhn (*DC-3/R2000 Project Engineer, Pan American World Airways*): "Certainly many items have been added to the aircraft that have increased drag. For instance, the installation of antennas, footballs or loop housings, etc., definitely increase drag. However, there are many modifications presently in the planning stages which will reduce these particular items and make the currently available horsepower more effective by reducing the drag factor. For example, we are thinking of installing such items as flush loops and doing away with the telescope-type antenna; we are removing the existing tailpipe extensions on the DC-3 and installing a short stack, also fairing in the tunnel area that formerly housed the exhaust tailpipe extension. In addition to reducing drag, this would reduce weight by approximately 100 lbs.

"There also are new anti-drag rings on the market which will materially reduce drag and possibly improve engine cooling. For years we have operated the DC-3 with an anti-drag ring that certainly can stand improvement. We have been flowing more air through the DC-3 engine than is necessary which in turn penalizes horsepower requirements. This fact has been proven on many types of aircraft in addition to the DC-3. Perhaps the most flagrant example of this was the *Stratocruiser*. Shortly after one airline began operating the aircraft, its flight crews observed the loss of 10 knots cruising speed. The recovery of these 10 knots was accomplished almost entirely by repairing the engine baffles and reducing the total airflow through the engine, permitting only that which was required for proper cooling. This same thinking can be applied to the DC-3, and it currently is being done."

Til Peabody: *"Bill Wiseman of Continental Motors has some thoughts regarding the reduction of drag to make horsepower more effective for the performance of the aircraft."*

Wm. A. Wiseman (*Chief Engineer, Continental Motors*): "We, of course, have to speak in terms of the flat-type engine instead of the radial, but there is a great deal that can be gained in an installation of our type engine by taking advantage of the fact the engine can be made flat. In so doing, we emphasize the flatness of the engine to reduce the frontal area, especially where it does the most good—in a wing installation. We have one example of an installation where the complete engine itself is only 19 inches thick. This results in an almost imperceptible thickening of the wing due to the nacelle.

"As far as cooling drag is concerned, we believe a lot can be gained by the reduction of cooling drag in terms of parasite drag through the use of augmenters on the exhaust. This takes advantage of the horsepower output of the engine when you need the most cooling to get the greatest amount of pumping from the exhaust energy to supplement the pressure drop through the cowl caused by the ram pressure in flight."

Til Peabody: *"Thank you, Bill.*

"SPEAKING *in terms of the flat-type engine instead of radials," reported Continental's Bill Wiseman (center), "much can be gained by taking advantage of fact that engine is flat. We emphasize this flatness of the engine to reduce frontal area in a wing installation"*

"ACCESSORY LOAD *that is taking over the powerplants today," said Ralph Harmon (center), "is a big problem. Sometimes the accessory load takes up as much as 100 hp. Our approach is to use an auxiliary powerplant to adequately carry this accessory load"*

"VAN DER HORST *has done considerable research in the cylinder-plate business, and its resultant product, Porus-Krome, will increase cylinder-barrel life up to 10 times while simultaneously reducing ring wear and lube oil consumption," said Ed Jones (center)*

Ralph Harmon of Cessna is well aware of this necessity to reduce drag and, I believe, has a program in effect."

Ralph M. Harmon (*Senior Project Engineer, Pawnee Plant, Cessna Aircraft*): "The accessory load that is taking over the powerplants in some business aircraft, particularly the larger twin-engine types, is a problem today. Sometimes the accessory load takes up as much as 100 hp, even more in a pressurized airplane. We have studied this problem rather carefully, and our approach is to get the accessory load off the prime powerplants by means of an auxiliary powerplant to adequately carry this load and leave the prime power for propulsion of the airplane. There is some question right now about the availability of suitable auxiliary powerplants, but that is a problem that can be licked. We at Cessna are sure it can be satisfactorily solved.

"Speaking as an airplane manufacturer, when we design an airplane, it is as aerodynamically clean as we can make it. But over a period of years the aircraft accumulates a number of barnacles, particularly after it gets into the hands of the user. It is very difficult to measure the effects of one bolt head or an improper lap joint on an aircraft, but hundreds of these

(*Continued on page* 34)

ROUND TABLE PARTICIPANTS

E. TILSON PEABODY, moderator of the meeting, is a former Navy pilot and also an experimental test pilot. He joined GM in 1945; became Director, Air Transp. in '48.

W. C. JAMOUNEAU has been associated with Piper Aircraft and its predecessor, Taylor Aircraft, for 22 years; has held a pilot's license since '32; is member of IAS.

E. W. CONLON joined Fairchild in 1953 as Director of Engineering. He is a graduate of MIT and served on aeronautical engineering faculty, Univ. of Mich., '45 to '53.

RALPH M. HARMON joined Cessna in 1953 to head up its transport category engineering division. He is in charge of development of Cessna 620 business plane.

ROBT. E. REED, senior experimental engineer, Allison, has been associated with Allison for past 15 years. He has been conducting flight research, turboprop, since '49.

JOHN S. GILLESPIE, vice president in charge of sales, Airwork Corporation joined that company in 1946. Mr. Gillespie was an Air Force pilot during World War II.

EDWIN R. JONES began flying with the USAF in 1951 and served as a jet fighter pilot in Korea, 1952-53; is presently sales engineer, pilot for Van der Horst Corp.

HAL HENNING, Operations manager, Air Transport Section, General Motors, has been an active pilot since 1925. He is a member of the SAE, IAS, Wings Club.

MIKE MURPHY has been active in aviation since 1928 and is one of world's best known stunt pilots. He is holder of Lund Trophy, CAA Award; joined Ohio Oil in '45.

JOE MASHMAN is a civil engineering graduate of University of Illinois. He learned to fly in 1939; taught flying, 1941; joined Bell as experimental test pilot, '43.

GEORGE T. PEW is a graduate of MIT. He became chairman of the board of Aero Design & Engineering when the company was organized in 1950; is member of IAS.

W. A. WISEMAN is an aeronautical engineering graduate of Univ. of Detroit and has been in aircraft engine industry for 22 years. Member of SAE and the Aero Club.

W. L. LITTLEFORD, Eastern sales manager of Texas Division of Bell Aircraft, joined Bell in 1942 and became affiliated with the Bell's Helicopter Division in 1946.

ARTHUR W. KUHN, project engineer on Pan American World Airways' DC-3/R2000 program, is based at PAA's overhaul center. He has been engine specialist for years.

BLACKIE MARTIN, sales and service manager of Steward-Davis, has been in aircraft engine business for 15 years, with USAF, Pratt & Whitney, Steward-Davis.

H. H. BOWIE is a mechanical engineering graduate of Iowa State College; served with Research and Development Division of Army Ordnance; joined Lycoming in '54.

GEORGE E. MEYERS, sales engineer and pilot for Monsanto Chemical Co., holds ATR 45852, and an A&E. During war, he flew with ATC; joined Monsanto in 1946.

by B. A. Bradenbaugh
U. S. Aviation Underwriters, Inc.

What About Crew and Passenger Insurance?

A complete business-aircraft insurance package answers management's obligation to its employees and guests aboard the company aircraft

A business concern has just purchased an aircraft for transportation of its personnel and guests. Competent pilots are employed; maintenance and operational procedures have been established; and Hull and Liability insurance purchased. Everything is all set to go except for one item. What about management's obligation to the employees and guests who will be passengers in this aircraft? Will their Life or Accident insurance be voided if they ride in a private, business aircraft?

Let's briefly examine the problem. While most individuals carry Life insurance against the usual hazards of occupation, some of the policies cover the full aviation hazard and others do not. Many firms encourage either Life or Accident insurance for their employees through company group plans. When a company aircraft is brought into the picture, the group plan can be examined to determine whether or not it covers. If it does not, the plan can either be broadened or new ones examined. In regard to an employee's personal Life insurance or Accident coverage, few people take the time to read the fine print, the specific details in their policies, and whether or not they would in this case is problematical.

In addition to the employees, there exists on the part of the company its obligation to guests. You cannot very well submit a questionnaire to each guest asking whether his individual or company insurance applies while he is riding in your aircraft. In addition to its possibly being embarrassing, it is not considered good form to even hint that anything could happen. Yet no company can afford to play ostrich and close its eyes to possibility.

There is a solution; several in fact. A reliable aviation insurance market can supply management with an overall package that includes Hull coverage, Liability protection, Medical Payments, Voluntary Settlements or Seat Accident coverage. Medical Payments is written on a per-seat basis and is self-explanatory since most people carry such coverage on their cars or are, at least, familiar with that coverage.

Voluntary Settlements, often referred to as "Admitted Liability," is written on a per-seat basis (including crew seats, if so desired) and offers to pay on behalf of management, pre-arranged sums as payments for loss of life, limbs or sight regardless of management's liability to passengers (or crew) in the aircraft. In other words, your company decides to carry, let's say, $25,000 or $50,000 or $100,000 on each seat and that sum is payable to the estate or next of kin of the occupant of each seat in the event of death arising out of an accident, or portions of that sum are payable to the occupant of each seat for the loss of limbs or the loss of sight.

What are the advantages of such coverage? For the employee, the money is paid regardless of Workmen's Compensation benefits since no release of liability is required. The employee and his family achieve peace of mind inasmuch as adequate benefits would be forthcoming in the event of an accident.

For the employer, the advantages are two-fold: 1) excellent employee relationships are established by payments of Voluntary Settlements; and 2) the employer is discharging his obligation to guests and, at the same time, preventing the possibility of future claims since when a guest loses life, limbs or sight, the pre-arranged sum is offered in return for "a release of liability" against the insured. Naturally, the sum must be high enough to satisfy the injured guest or his next of kin. Such action, when handled by the expert legal staff of a top-flight aviation insurance market, not only promotes good business relations but also precludes involving the insured in a future legal controversy.

Seat Accident coverage is identical to Voluntary Settlements with one important difference. In regard to a guest, no release of liability is required. You might wonder why it would not be easier to write Seat Accident coverage rather than Voluntary Settlements. Fact of the matter is there is an important premium difference since under Voluntary Settlements, the cost of Passenger Legal Liability is materially reduced. If a guest refuses to execute a release of liability, the insured is then protected by his Passenger Legal Liability in the event of a lawsuit. With Seat Accident coverage, an insured must pay the full premium for Passenger Legal Liability since the guest can take the sum of money and use it to institute a claim against management. This could involve undesirable publicity, prolonged trials and may not, in some cases, even achieve the purposes for which management bought in insurance. However, let it be stated that those firms preferring Seat Accident coverage rather than Voluntary Settlements argue that no strings should be attached to any financial offer. The pros and cons of this argument could go on *ad infinitum*. The important point is that both forms are available and management has its choice.

When management completes its insurance package by purchasing Medical Payments and either Voluntary Settlements or Seat Accident coverage, than the green light is on for proper operation of its business aircraft with the problems of employees and guests neatly tucked into their proper niche. Does your aircraft have a green light?

SKYWAYS FOR BUSINESS

News Notes for Pilots, Plane Owners Operating Aircraft in the Interest of Business

ROGER SHERMAN TRANSFER CO. *recently took delivery of this new Model 47H-1 Bell helicopter. It will be used to carry supervisors on inspection trips of operations*

Last PanAm DC-3's Now on Executive Aircraft Market

New York, N.Y. The last of a group of DC-3's are being retired by Pan American World Airways and, after modification, will be sold as deluxe executive aircraft. These modifications, including installation of more powerful DC-4 engines, will enable the "new look" version, dubbed the Hi-Per DC-3, to operate at greater speeds, with bigger payload and at higher altitudes. The trio of DC-3's, still good for many more miles of flying, are to be sold to business-plane users after the Hi-Per DC-3 modification.

Procedure Developed for Removing Blower Gum Deposits

St. Louis, Mo. Using a solvent produced by Monsanto Chemical Company, American Airlines has developed a procedure for removing carburetor blower section gum which markedly restores aircraft engine horsepower. The method eliminates the need to disassemble engines prior to scheduled time due to power losses that are the result of excessive blower deposits. Restoration of up to two inches MP is common. The solvent used is orithodichlorobenzene, a technical grade of ortho with a maximum of 0.01% of hydrochloric acid.

The developed procedure for Pratt & Whitney R-2800 and R-2000-13 engines is:

A ½-inch ID rubber hose, long enough to reach the ground, is connected to the carburetor adapter. With the engine running at 1300 rpm, the end of the hose is inserted into a container of ortho and two or three gallons is siphoned into the blower section. This takes about 30 minutes. The slow siphoning is said to be more effective than force feeding which has a tendency to result in dilution of crankcase oil.

Caution: Treated engines are not run above 1500 rpm at 30 MP until all spark plugs are changed.

Booklet on P&W R-1830-94 Now Available to Operators

Gardena, Calif. An illustrated 42-page booklet entitled "Setting the Record Straight on the Pratt & Whitney R-1830-94 Engine," has been issued by Steward-Davis, Inc., in an effort to dispel misunderstandings concerning the performance and availability of that engine. The booklet compares the actual increased performance of the R-1830-94 powered DC-3 and Lockheed *Lodestar* with the -92 powered aircraft. It also compares the -94 with other available replacements for the conventional -92 powerplant, and documents the military and recent commercial record of these 1350-hp engines in a number of executive -3's and *Lodestars*.

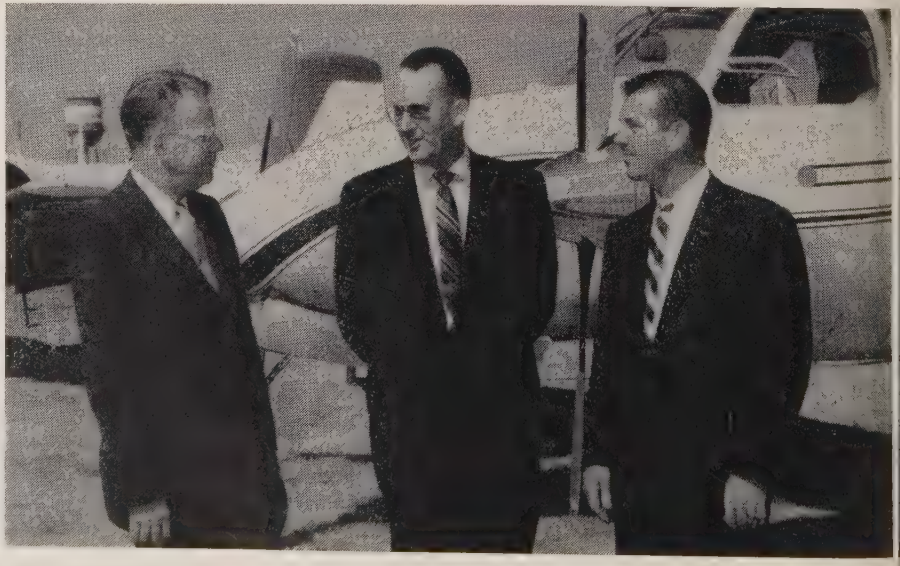
Steward-Davis, Inc. assisted in obtaining the original certification (1951) for the installation of -94 in DC-3's and *Lodestars*, and copies of the booklet are available to pilots and operators. A letter to S-D at 13501 South Western, Gardena, Calif., will bring the booklet to you.

AC Spark-Plug Announces New "All-Weather" Model

Flint, Mich. A new "all-weather" spark plug for executive-type aircraft has been announced by the AC Spark Plug Division of General Motors. Designated HSR-86, the new plug has been CAA-approved for extensive use in business aircraft.

"An outstanding feature of the plug," reported H. P. Stanley, director of AC's aviation sales, "is its ability to seal against moisture, salt, and dirt, regardless of altitude. Construction of the plug is such that ground-level atmospheric pressure is maintained inside the plug even at very high altitudes, thus eliminating 'rough engine' and 'misfire' that often occur with other type aircraft plugs.

"This results in better engine performance," Mr. Stanley added, "longer spark plug life, and virtually eliminates unscheduled plug removal."



NEW TWIN BONANZAS *recently were delivered to Lockheed for use as executive transports. They were accepted from Norman Larson (left) by Tony LeVier and H. R. (Fish) Salmon*

CAA Approves Mitchell Auto-Copilot on C-50

Van Nuys, Calif. Planeservice, Inc., the maintenance organization associated with The Norman Larson Co., at San Fernando Valley Airport, has secured CAA approval of the Mitchell "Automatic Copilot" in all *Twin-Bonanzas*. The Mitchell is an aileron-operated autopilot which offers complete directional control.

According to Mr. Larson, the Norman Larson Co. has found The Mitchell to be particularly suited to modern business aircraft, and maintenance and operation of the unit to be remarkably trouble free.

Planeservice will install a Mitchell in a B-50 or C-50 *Twin Bonanza* for $1,600.

CAA Makes Recommendation for P & W R1830-Equipped DC-3's

Los Angeles, Calif. The CAA Powerplant Branch reports that the opening around the oil cooler on all DC-3 and C-47 aircraft equipped with P&W R1830 engines presents a potential fire hazard in the event of an accessory section fire, by allowing the flames to pass into the wheel well. To prevent this condition, CAA recommends that a steel baffle plate be installed around the aft end of the oil cooler between the oil cooler and the lower cowling, with an asbestos seal between the steel plate and the lower cowling panel.

If you would like to follow the CAA's safety suggestion, write to CAA, P.O. Box 45007, Airport Station, Los Angeles, Calif. Attention: Powerplant Branch, for a template for the steel plate.

Humble Oil and Refining Adds Two S-55's to Fleet

Grand Isle, La. Two Sikorsky S-55 helicopters recently were delivered to the Humble Oil and Refining Co., Grand Isle, La. This brings Humble's fleet of S-55's to five. The copters are used to transport personnel and equipment to Humble's oil drilling rigs in the Gulf of Mexico. Prior to purchasing its own aircraft, Humble operated leased helicopters for more than a year. Referring to the company's decision to buy its own copters, one Humble official reported it had proved both "practical and economical."

Roger Sherman Transfer Co. Buys Bell 47H-1

Fort Worth, Texas. The Roger Sherman Transfer Co., East Hartford, Conn., added a new dimension to its expensive hauling and rigging business with the arrival recently of a customized Model 47H-1 Bell helicopter. Primary function of the new copter is to enable company officers and supervisors to personally inspect their widespread operation. In addition to using the Bell to improve coordination of operations and minimize executive travel time, the 47 is used to expedite the moving of parts and men to repair disabled equipment on the road, and perform aerial reconnaissance of jobs to be handled by the company.

. . . . in the business hangar

A new 11-place *Learstar* recently was delivered to the Evening News Publishing Co., of Dayton, Ohio. The plane will be used for the transportation of personnel between the company's operations in Springfield, Ohio, Atlanta, Georgia, and Miami, Florida.

Bob Kusse, chief pilot for Fruehauf Trailer Co., Detroit, brought his company's Twin Beech to Remmert-Werner Engine Works for a double engine change. Bob is also Fruehauf's NBAA representative.

Luke Moseley and John Hughes of Pepsi-Cola brought the company's *Lodestar* to Butler Aviation, LaGuardia, for 100 hour inspection and relicense. Luke is the Pepsi chief pilot and NBAA representative.

Bohling Aircraft Corp. of Chicago recently installed a Flite-Tronics MB-3 marker beacon receiver and CA-1 audio amplifier in Carl Norton's Cessna 310.

E. P. Jeter and Jim McCoy flew Union Producing Commpany's *Lodestar* and *Mallard* to Executive Aircraft Service, Dallas, for maintenance. The *Lodestar* received an engine change and miscellaneous repairs, while the *Mallard* was given a 100 hour inspection, and new cabin headliner and side panels installed. Mr. Jeter is chief pilot and NBAA representative for Union Producing Co.

Jimmy Boyd brought Shamrock Oil & Gas Corporation's *Lodestar* to TEMCO's Greenville (Texas) plant for bladder-type fuel cell installation. Home base for the *Lodestar* is Amarillo, Texas.

J. G. Flynn, pilot for Collins Radio Co., brought the Collins Twin Beech to Southwest Airmotive for minor repairs.

Marathon Corporation, Menasha, Wis., has had its *Aero Commander* equipped with a Flite-Tronics MB-3 marker beacon receiver, and a CA-1 audio amplifier. Installation was made by Northern Air Service, Grand Rapids, Mich.

Hank Schiebel and Jack Schnable brought Grumman's Super-92 DC-3 to Remmert-Werner for an engine change.

Wimpy Neel brought the DC-3 belonging to E. W. Brown, Jr., to Executive Aircraft Service for a 100 hour and an annual inspection, plus miscellaneous repairs. The -3 is based at Orange, Texas.

Butler Aviation at LaGuardia Field has completed the gross weight increase and main spar modification on the de Havilland *Dove* owned by Consolidated Trucking Lines, Toronto, Canada. Colin Campbell and Joe Gebura ride the front office of the business *Dove*.

Southern California Aircraft Corp., Ontario, Calif., recently delivered a newly converted executive DC-3 to the Aerojet-General Corp. Chief pilot for Aerojet is Frank Dolinski.

One of Burlington Industries' D18's recently was given a Remmert-Werner C-18 conversion, complete with big picture windows, enlarged cabin area, and a new exterior paint job. The conversion was done during a 1,000 hour inspection and overhaul, and included installation of a Sperry C2 gyrosyn compass, a Collins 51R omni and RMI, and a custom-designed instrument panel. Shelby Maxwell, Burlington's chief pilot and NBAA representative, brought the Twin Beech to St. Louis and Remmert-Werner.

Doubleday & Company's Twin Beech is flying again after a 1,000 hour inspection and an engine change at Butler Aviation, LaGuardia. Charles Wellstead and Sam Burkes are Doubleday's pilots.

The Vincent & Welch DC-3 now boasts new cabin upholstery and trim and a new outside paint job by Executive Aircraft Service. John R. Henry is V&W's chief pilot and NBAA rep. Home base is Lake Charles, La.

Bob Burke brought Lauhoff Grain Company's Twin Beech to Remmert-Werner for radio work, 100 hour inspection, and installation of new equipment, including a Collins 17L4 360-channel VHF transmitter and a Collins 51R3 VHF receiver and omni.

W. J. Rogers, Gardner Advertising Agency (St. Louis) account executive and his pilot, Jack Taylor, brought the Gardner Cessna 195 to Southwest Airmotive for minor maintenance and a visit. Mr. Rogers was in Dallas on business and he and Mr. Taylor took advantage of the stop-over to say Hello to their SAC friends.

With cold weather here, there's been a rush on new deicer boots installations at Remmert-Werner. In the R-W hangar for new deicer boots were three of Monsanto Chemical Company's DC-3's, and DC-3's belonging to Falstaff Brewing, Gaylord Container, and Federated Department Stores.

PLANE FAX

Your Best Week-end Flight Plan for December

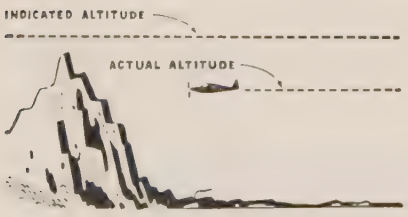
The beautiful Las Posadas—"The Seeking for Lodging"—will be enacted on Olvera Street in Los Angeles December 16-24. Plan to see it, and to land at near-by Long Beach Municipal Airport or Lockheed Air Terminal at Burbank for quality Standard Aviation products and service.

13,000 channel crossings in two years

Flying the world's shortest airline run, Dick Probert's Avalon Air Transport planes average 17 minutes a flight over the 32 miles between Long Beach, California, and Avalon Bay on Catalina Island. The route is one of the world's busiest, too, with up to 47 flights a day, and a total of 13,000 crossings and 75,000 passengers carried since the first flight in August of 1953.

"The open sea is one big airport for our Grumman G-21's," says Mr. Probert, "so our over-water flights hold few dangers. But they really give our 450-horsepower Pratt & Whitney's a workout. Long, full-throttle water take-offs, short flights, salt-water spray on the engines; they all call for the best possible lubrication. We get it, too—RPM Aviation Oil gives us 1100 hours between overhauls. And the engines are in good condition even after that time; we overhaul them just for preventive maintenance.

"Another problem we have is very high head temperatures because of our water take-offs. But Chevron Aviation Gasoline 80/87 has always prevented detonation, and given us full power when we need it. Never fouls plugs, either."



TIP OF THE MONTH

It's not true that a pressure altimeter always gives actual altitude in flight. Temperature, outside pressure changes, etc., can cause errors as much as 2000 feet in altitude reading.

New Robinson Mount Extends Life of ADF

For several years, airline and business-aircraft operators have experienced chronic difficulties with some of the ADF equipment in use. The equipment becomes inoperative after comparatively short periods of use, thus necessitating complete removal of the unit from aircraft for servicing.

All too frequently, it is the malfunction of vacuum tubes that causes the trouble. Although actual replacement cost is not significant, the large number of man-hours required to remove, service and reinstall the equipment results in a substantial bill. Equally unattractive is the lay-up time while the aircraft is without the equipment.

A large percentage of the failures have been traced to inadequacies in the present mounting systems. Robinson Aviation, Vibration Control Engineers of Teterboro, N. J., have engineered and are now manufacturing a modification kit which replaces the obsolete rubber mountings of original installations. This new mount incorporates Met-L-Flex resilient elements which provide vibration isolation and shock protection far exceeding spec requirements. Unaffected by passage of time or exposure to heat, cold, water, dust, ozone or changes of atmosphere pressure, they require no maintenance.

The CAA has issued Radio Modification Sheets for a large number of ADF equipments, which state in part "the proposed change is considered to be desirable in the interest of *improving the life and reliability* of the vacuum tubes. Modification requires no more than 5/16 additional clearance in the vertical displacement only.

Remote Control of Airways Stations Tested

A 90-day evaluation program to determine the practicability of remote operation of adjacent or alternate airways communications stations was started October 1 with the remote operation *of* FRONT ROYAL, Va., GREEN BAY, Wisconsin and FORT BRIDGER, Wyo., *by* MARTINSBURG, W. Va., WAUSAU, Wisc., and ROCK SPRINGS, Wyo. respectively. The actual stations will not be discontinued nor their personnel removed, but their functions will be carried on by the "controlling" station. Thus the MARTINSBURG station will answer all radio calls to "FRONT ROYAL RADIO" via remote line to the FRONT ROYAL transmitters, and, except for local weather observations, all other functions of the FRONT ROYAL station will be handled by direct telephone line to the MARTINSBURG station.

These latter services include pilot briefing, weather information, flight advisory services, filing and closing of flight plans, route and other information. If successful, the plan may be extended countrywide to save facilities that might otherwise be shut down for lack of sufficient evidence of public need, while enabling CAA to effect economics badly needed for other and expanded services.

ARC Takes Over New Orion Course Director

The old saying is that if you build a better mouse trap, the world will beat a path to your door. In today's highly technological age, if you turn up with a new and improved electronic device, some large established company is almost sure to buy you out of the field (and possible future competition). So it is with the Orion Course Director on which we reported last year.

Aircraft Radio Corporation has started full-scale production of its new CD-1 Course Director. This system has been developed from designs acquired in the purchase early this year of Orion Industries, Inc. Orion laboratory and plant, formerly located at Richmond, have been moved to ARC's plant at Boonton, New Jersey.

According to A. W. Parkes, Jr., ARC vice president in charge of sales, deliveries have been planned on orders received to August 15th so that they will be completed by December.

The CD-1 is a heading computor system, with a compass-slaved gyro furnishing accurate, stabilized directional data for instrument approaches and in-flight tracking on omni and visual-aural VHF ranges. The total weight of the equipment which comprises the course director system is under 10 pounds. Its low power requirements are 3.5 amperes at 14 volts direct current, or 2 amperes at 28 volts d.c. Many of these are scheduled for installation with ARC Type 15D omni equipment during next four months.

ELAPSED-TIME CLOCK *is manufactured by Wakmann to fit a standard panel opening*

New Elapsed-Time Clocks Offered by Wakmann Co.

Only recently introduced, new eight-day elapsed-time aircraft clocks are already being installed as standard equipment on many of the new large transports being delivered to airlines throughout the world, as well as being produced in quantity for the Air Force.

These new clocks fill a long-existing need for an improved and simplified elapsed-time chronograph aircraft clock with a precise and accurate movement that can be directly and easily read in accordance with operational practices, and at moderate prices. Made with either the 12- or 24-hour dial, center chronographic sweep second- and hour-register hands, the new A-10-A clocks are manufactured to fit standard panel openings. Matte white markings are on a black background, and the works are encased in a lightweight oxidized-aluminum case. Offered by the Wakmann Watch Co., Inc., 15 West 47 St., N.Y. 36, N.Y.

They also make an eight-day for single-engine and the new light-twin class aircraft with an ETA device; two dummy hands, one painted on the crystal itself and the other attached to a center knob, both adjustable so that the pilot can set in his ETA and adjust it as it appears necessary. He thereby has a constant, visual reminder of remaining necessary flight time for fuel and flight-plan checking.

Two Accidents Charged to Careless Navigation

"Death is costly—also permanent!" This brief but pointed motto on a simple card is the subject of a widespread

safety program that has been established in both private and governmental organization. It might well be printed in a handy pocket size and be posted on the instrument panel of every cross-country airplane. Despite the resentment of many pilots to the suggestion, it is an undeniable fact that too many fatal accidents have been proved to be the result of careless navigation and procedures.

This point recently was illustrated by two CAB accident reports just released. Both occurred within 10 days of each other last November. The first occurred when an oil company Lockheed PV-1 crashed near Waynesburg, Virginia, at night. The aircraft was on a VFR flight (originally) from Texas to Baltimore, Maryland. Although *no flight plan was filed,* the pilot did get a proper weather briefing before takeoff and knew that instrument or on top flight would be necessary beyond Atlanta, Georgia. A landing was made at Atlanta, the aircraft fueled and IFR plan filed. After a ground delay for ATC, the flight was cleared at 11,000 ft via Green 6 and Red 77 to Lynchburg, Va., Red 37 to Gordonsville, Va., Red 13 and Red 17 to Baltimore, Md.

The flight encountered ice at 11,000 near Spartanburg, S. C. and obtained ATC approval to climb to 1,000/on top which turned out to be 16,000 ft. At Greensboro, N. C., the pilot requested and was cleared back down to 11,000 ft. Over Lynchburg, the flight was cleared to descend to 10,000 ft between Remington and Arcola. The Baltimore weather was then transmitted to the pilot as "Scattered clouds 1,000 ft, estimated ceiling 7,000 ft, overcast, visibility 3 miles, light rain and haze, temperature and dewpoint both 61: Washington weather was given as "Ceiling measured 8,500 ft, overcast, visibility 10 miles, light rain, temperature 60, dewpoint 57, pressure falling rapidly." This report was then about an hour old! Pilot promptly *cancelled IFR plan* and this was the last radio contact!

Thirteen minutes later it crashed in an open field 24 miles northeast of the Montebello VOR and 35 miles WNW of the Gordonsville VOR, at an elevation of 2100 ft msl. The surrounding hills in that area ran up to over 4,000 ft msl and fog and low-lying clouds were observed to exist at the time as low as 2,000 ft. The aircraft was both observed and heard by numerous witnesses, among them a former Air Force mechanic, circling in and out of the low-lying cloud bases, and observed to nearly hit a tall, flood-lighted marble edifice (a tourist attraction) on a mountain top, and also an 85-ft high statue at the same location. Occasionally, the pilot put his landing lights on

(*Continued on page* 30)

Air-Aids Spotlight

AKRON-CANTON, Ohio — *Tower LF frequency changed to 278 kc.*

ASHLEY-BISMARCK, N. Dakota — *ASHLEY MHW ADF beacon frequency changed to 338 kc to accommodate change of BISMARCK LFRange to 230 kc.*

ATLANTIC CITY, N. J. — *VARange on 108.7 mcs permanently decommissioned. See COYLE.*

BECKLEY, W. Va. — *VOR test unit on 109.8 mc operating 4 mi ESE of Raleigh County Airport between CHARLESTON and PULASKI/ROANOKE. HUNTINGTON site also being investigated.*

BEDFORD, Mass.—*Outer Compass Locator decommissioned, replaced at same location by H-type radio beacon on 269 kc, ident "BED".*

BLANDFORD, Mass.—*VOR site being tested to fill gap in ALBANY - GARDNER - HARTFORD-POUGHKEEPSIE quadrangle at intersection of Victor Airways V-39/106 and V-130.*

BOSTON, Mass — *ILS Middle Compass Locator & VHF Marker moved out from Runway 4 approach end approximately .2 mile, still intersects glide slope below approach minimums.*

BRADLEY, Conn.—*NEWARK-WESTCHESTER Lo-Altitude Control may be extended to this busy HARTFORD terminal.*

CHICAGO, Ill.—*O'HARE Field now requires functioning two-way radio.*

COYLE, N. J.—*VORW installed on busy Victor 1 airway just north of ATLANTIC CITY. Frequency 113.4 mc ident "CYN".*

DOTHAN, Ala.—*BTVOR being tested on 111.6 mc at the airport.*

FORT LAUDERDALE, Fla.—*BROWARD COUNTY Tower resumed seasonal operation on 272 kc, 121.3 mc.*

FORT MYERS, Fla.—*LFRange converted to H-type ADF beacon same frequency.*

FORT WORTH, Texas—*AMON CARTER ILS Back Course procedure turn now East of southeast course account new obstruction. MECHAM Tower now operates 0700-2300 only.*

GREENWOOD, Miss. — *VOR/DME recommissioned in new location 5 mi WSW of airport on 114.2 mc.*

JACKSON, Tenn. — *VOR shut down for relocation 10 miles northeast on LFRange course near Lexington, Tenn.*

KNOXVILLE, Tenn. — *Recommissioned Glide Slope crosses Outer Marker at 2650 ft, Middle Marker at 1160 ft.*

LAKE CHARLES, La. — *VOR relocated 3 miles 120° from LFRange, frequency changed to 113.4 mc.*

MELBOURNE, Fla. — *Southeast course LFRange swung west to 342°, aligning Amber Airway 7 direct WEST PALM BEACH and virtually coincident with Victor Airway 3.*

MINNEAPOLIS, Minn. — *ILS and LFRange procedure turn altitudes, also LFR initial and final approach altitudes raised 200 ft.*

NEW YORK, N.Y. — *IDLEWILD ILS straight-in minimums varying between 200-½ and 400-¾ according to whether newly commissioned centerline approach lights are operational.*

NIAGARA FALLS, N.Y.—*ILS Localizer identifying "IAG", LOM now "IA" and LMM now "AG", frequency unchanged.*

OCEANSIDE, Cal. — *VORW commissioned on 115.3 mc, ident "OCN" located about 1 mile NW of ADF radio beacon on Amber 1 (Victor 23) LOS ANGELES to SAN DIEGO.*

OMAHA, Neb. — *Recommissioned Glide Slope crosses LOM at 2286 ft, LMM at 1217 ft.*

PEORIA, Ill.—*CAUTION on using newly approved VOR approach. Unlighted high-tension towers between VOR stations and field up to 800 ft msl!*

WILKES-BARRE-SCRANTON, Pa.—*Correct item October Spotlight: ILS frequency 109.9 mc.*

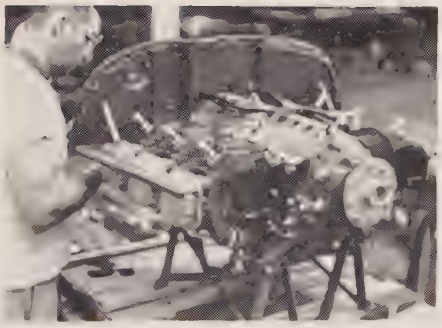
The New '56 all-metal Cessna 170

MORE FOR YOUR MONEY...NEW BEAUTY...NEW COMFORT...NEW QUIETNESS

Again in '56—you get more for your money in the new Cessna 170! More than 100 extra-value features you won't find on any other low-priced airplane. Dependable, proved performance, smoother operation, greater comfort and safety. Easily adaptable for floats and skis. Yet this all-metal, 6-cylinder airplane sells at the same low price of only $8,295, f. o. b. Wichita.

10 sq. ft. flaps

Big, wide "Paralift" flaps on the Cessna 170 are easily operated through 4 positions, give the Cessna 170 the shortest landings, quickest take-offs in the low-priced field.



Smooth 6-cylinder power...with new low sound level

The Cessna 170 offers you a dependable, powerful 6-cylinder, 145 H. P. engine! So smooth, quiet, vibration-free that a child can sleep peacefully on its comfortable foam rubber seats. Spacious interiors plus striking color schemes contribute to the extra comfort of the new Cessna 170.

See the '56 Cessna 170 at your Cessna dealer now (he's listed in the yellow pages of your phone book) or write CESSNA AIRCRAFT CO., DEPT. S-1, WICHITA, KANS.

4 GREAT CESSNAS
THE COMPLETE AIR FLEET
FOR EVERY BUSINESS NEED

Cessna 170 172 180 310

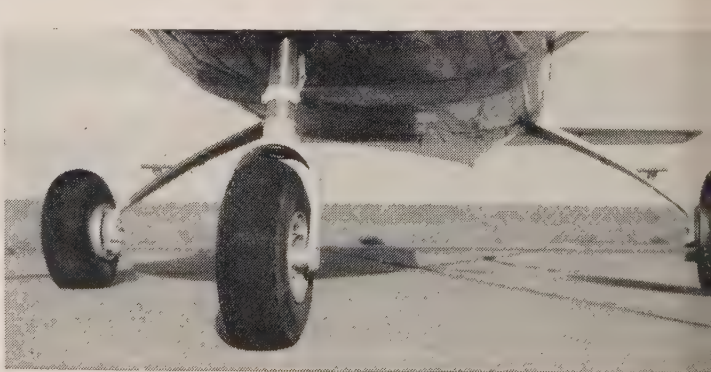
Cessna announces a new.

The Cessna 172—so completely ne

The most exciting airplane in many a year . . . so completely different in landing, taxiing, take-off characteristics, it makes flying like driving! You actually "drive" the new Cessna 172 . . . out to the runway . . . into the air . . . back down to the ground!

Wonderful new steerability! You can turn and park the Cessna 172 easier than your automobile! Patented, wide-span, *Land-O-Matic* gear—a lower center of gravity—combines with such Cessna features as extra-big Paralift-Flaps, large tail giving greater stability and Cessna High-Wing design to make all this possible. Dependable, 6-cylinder Continental 145 H.P. engine. Striking new interiors make the all-metal, 4-place Cessna 172 tops in luxury and comfort. Ask your Cessna dealer to demonstrate it TODAY . . . (only $8,750 f.o.b. Wichita). He's listed in the Yellow Pages of phone book or write CESSNA AIRCRAFT CO., DEPT. S-2, WICHITA, KANSAS.

GREATER VISIBILITY: The all-new Cessna 172's level attitude, plus its extra-big, wrap-around windshield, provides the best visibility in the low-priced field. You can taxi with ease.



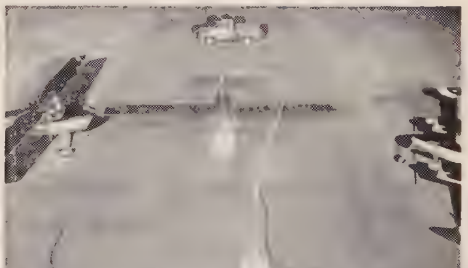
RUGGED, WIDE-SPAN, LAND-O-MATIC GEAR absorbs sho allows smooth, safe landings, prevents nosing over. In the air, t nose wheel does not turn when rudders are activated. This c drag, increases speed. Lets you freely land and taxi cross-wi

afer . . . easy-to-fly airplane

makes flying like driving!

E-OFF: The patented, wide-span, *d-O-Matic* gear lets you lift nose el above mud or obstacles almost ediately after applying power. As sult, there is less ground drag, short -off run.

LANDING: The new Cessna 172 lets you relax . . . virtually lands itself. Wide, spring steel main gear, strong, shock-absorbing nose support and low center of gravity make landings easy, smooth. Holds straight heading.



GROUND HANDLING: Cessna 172's individual toe-operated brakes combine with the steerable nose wheel to give you more complete control. Using either brake, you can make a complete turn—even in high winds—in a few feet.

Inquire about Cessna Lease Plans

4 GREAT CESSNAS—THE COMPLETE AIR FLEET FOR EVERY BUSINESS NEED

Cessna

170 172 180 310

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

CAA Issues Bulletin on Radar Installations

Recently the CAA Aircraft Engineering Division issued a bulletin on the installation of radar in aircraft and the items to be considered prior to approval, all of which are described in some detail.

In brief, it is pointed out that in addition to requiring the radome and its supports to be structurally satisfactory, associated changes in the electrical system also must be reviewed to determine whether the addition of radar will overload the generating system. In this regard, if the radar is to be used during single-engine operation, the rating of the remaining generator must be adequate for all appropriate electrical loads.

Should the radome appreciably change the airplane configuration, certain flight tests may be required to demonstrate that no adverse flight characteristics, flutter or vibration, are introduced. The effect of radar on other components such as the magnetic compass and the ILS reception, with and without approach coupler, is also investigated. The scope and controller location in the pilot's compartment must be checked to preclude interference with airplane and engine controls during emergency operation procedures, and the airspeed system is to be recalibrated if the pilots are relocated.

Safety Device Developed for Use on Twin Beech

Invention of a safety device that warns pilots against inadvertent retraction of Beechcraft C18S landing gear has brought Frank P. Davis, Deputy Chief of the CAA's aircraft control division, an award of $250 from this agency.

For several years the CAA, like many aircraft operators, experienced an average of one wheels-up landing a year, and the average repair cost was $6,000. Since Davis designed and CAA mechanics installed the warning device, there have been no such accidents in CAA. The device consists of a guard over the gear retraction switch which, if it is lifted while the plane is on the ground or at any time the plane does not have flying speed, blows a loud horn in the cockpit.

There are 882 twin-engined Beechcrafts certificated in the United States, according to CAA records, many of them being in use as business aircraft operated by industrial and business firms. NBAA has recommended the warning device to all members using Beechcrafts, and the Flight Safety Foundation has urged its adoption. Davis estimates that a kit for the device could be sold at about $10 and installation should not cost more than $25. All CAA Beechcrafts are being so equipped as they come up for certain maintenance operations. Details of the warning device, including drawings for installation, are available from the CAA for anyone interested.

"We spent long hours investigating these belly landings," Davis said in discussing his device. "It was almost impossible to determine whether mechanical malfunctioning or human error caused most of them, and prevention of such accidents by some manual means seemed to be the proper solution. With this warning in the cockpit, it would be difficult for a wheels-up landing to be made inadvertently."

CAA Evaluating New ATC Display Units

The CAA Airways Operations Evaluation Center at Indianapolis, Indiana, recently began a series of evaluation tests conducted by experienced controllers in the Airways Operations Evaluation Center quarters which are adjacent to those of the Indianapolis Air Route Traffic Control Center. The initial tests will include the evaluation of new traffic control displays, the use of radar in enroute control, and studies of pilot/controller communication techniques.

The geographical area involved in the initial phases of evaluation will include Lafayette, Terre Haute, Indianapolis, and Scotland, Indiana. Radar information will be derived initially from ASR-2 equipment at Indianapolis.

Pilots flying through this area will be requested by the control agency to participate in these evaluations. The degree of participation requested will vary from monitoring discrete ARTC frequencies to the acceptance of the radar vectors.

A NOTAM of this operation has been included in the *Airman's Guide*. Business pilots are urged to cooperate with the CAA during these evaluation tests.

Airport Hospitality Can Provide Rich Dividends

During the recent "Airport Crusade" that brought Congressional approval for a substantially enlarged federal air transport program, the airport sponsors compared airport and highway needs. How can an airport-use fee now be accepted when there is no such fee for use of public roads?

This does not that an airport should be operated at a loss. It does mean that airport management should welcome public air traffic and plan to get the necessary revenue through the fixed-base operator and some of the 100 or more consumer services that have been found helpful financially at hundreds of airports.

Today, the automobile service station operator, banker, food market, theatre and department store have all provided acres of hard surfacing so that patrons can drive in, park and do business. With that trend in free access facilities for the patron's convenience, airport landing fees today appear to be a bad business policy.

Landing charges are expected by the airlines and those operating aircraft for hire. The public carriers and truckers on the public roads pay higher license fees and sometimes franchise taxes for their special commercial use of the roads. But the thousands of business-aircraft operators want the same freedom on public airports that they have on public roads. Most airport operators are accepting that fact, putting out the welcome mat and planning better ways to get the needed revenue from contented patrons and their friends.

Hospitality can pay any airport rich dividends. More revenue is possible from the fixed-base operator if his lease agreement is on a percentage basis. The limousine, taxi and rental car services also could provide more revenue. The restaurant, snack bar, drug store, newsstand, coin lockers, telephones, rest rooms, and other consumer services will produce more if the airport is known for genuine hospitality.

Improved Airports and Landing Strips Needed

A CAA publication titled "Small Airports" says in the opening paragraph—"Every community, whether large or small, needs access to the air highways. This access can be obtained only through an airport. Frequently there is a large airport within acceptable travel distance from your town which serves the scheduled airlines. This airport, however, is often too far removed or is crowded to such an extent that it does not adequately serve private-aircraft operation. In such a place there exists a need for a small airport."

That introductory statement is as good today as when it was written in 1951. But, the story on (a) why build an airport; (b) who will use the airport; (c) how should planning be organized; (d) who will assist in the planning; (e) what design features should be used; (f) what building will be needed; and many suggestions about construction require—in

NBAA's opinion—a critical study from the 1956 viewpoint.

Community airports, used by business, private and local service aircraft operators, can be as large or small as local needs dictate. But, improved and standardized airport or landing strip facilities must be provided if air-age transportation is to follow the general pattern of highway vehicle use in our way of life. "Commercial air transport services, personal flying, business and agricultural aviation—all have become essential parts of our modern, everyday way of life. The American people have accepted the airplane as a primary means of travel." (The President's Civil Air Policy Report.)

Collins Offers Modification Kit for 17L-4 VHF Transmitter

A modification kit has been developed by Collins Radio Company for their 17L-4 VHF transmitter to incorporate what is known as "speech clipping."

The use of a speech clipper in a transmitter has the effect of maintaining a continuous, high modulation percentage and provides more intelligible audio transmission. The transmitter's modulation amplifiers are utilized more efficiently since a higher amplication potential is used.

Collins reports the following benefits are offered through "speech clipping:"

1. Constant percent of modulation for a wide range of audio voice levels.
2. Greater range of voice frequencies are transmitted, resulting in improved readability of the transmission.
3. Distorted audio signals, as a result of over-modulation, are eliminated.

The only significant precaution that must be taken is the proper adjustment of amplifier gain in order to avoid over-accentuation of the hiss that is found in carbon microphones. Price of the kit is $68. When incorporated at the factory, the kit changes the transmitter designation to 17L-6.

Flight Safety, Inc. Reports Landing Gear Failure on DC-3's

In a Flight Safety Newsletter distributed to many executive aircraft operators, Flight Safety, Inc. reported two instances of landing gear failure on DC-3's. Examination of one of the DC-3's that suffered a collapse of one landing gear revealed that *1)* the actuating strut adjustment was one-sixteenth inch short and *2)* the tension in the "positive lock" cable when in the "spring lock" position was 28 pounds instead of approximately 60 pounds.

The gear-collapse on the second DC-3 occurred when the rear brace strut failed just aft of the weld at the fork. This weld exists only on the lightweight landing gear and on some of those landing gears converted to the heavy model. The original C-47 landing gear uses a bolted member in place of the weld.

As a possible preventive measure, Flight Safety, Inc. reports, the inside of the tube should be coated with a lubricant such as Lion oil by removing the Allen plugs which exist for this purpose. This is standard procedure on all tubular structures, including engine mounts.

Flight Safety, Inc. also suggests that pilots check the actuating strut adjustment and the cable tension at the time of landing gear retract checks.

NBAA-Member Bill Lear Gets a New Cessna 310

Bill Lear, Sr., board chairman of NBAA-member Lear, Inc., recently established residence in Geneva, Switzerland in order to conduct a three-year study of European aviation products and markets. To facilitate his work in Europe, Bill Lear purchased a Cessna 310 which his son, Bill Lear, Jr., recently flew from Detroit to Geneva. The solo delivery flight included stops at Goose Bay, Labrador; Bluie West 1, Greenland; Keflavic, Iceland; and Paris, France. Special fuselage fuel tanks installed in the Cessna 310 carried 150 extra gallons of fuel, and each trip segment was completed with at least four hours fuel remaining. Total flight time was 25 hours, 46 minutes, for an average speed of 188 mph.

Bill Lear, Sr. will use the twin-engine 310 for demonstrating Lear communications, navigation, and automatic flight control equipment. In its role as demonstrator, the 310 will carry what probably is the most extensive complement of avionic equipment ever installed in a light-twin. This equipment includes a Lear L-5 autopilot with automatic altitude controller, ILS approach coupler, and navigation coupler for flying omni and for holding pre-selected headings; a Lear VGI, Lear NAFLI instrument flight system, an LTR-800 VHF (800-channel transceiver), an LVTR-36 (36-channel transceiver), a Lear 5600 MHF receiver and 5636 transmitter, a Lear ADF-14C and 15, a Collins omni indicator, glide-path receiver and heading and course selector, and a Lear broadband antenna.

New Members

Aerojet-General Corporation
Azusa, Calif.
NBAA Rep: G. E. Rice
Company operates: two deHavilland *Doves*, a DC-3.

Rich Wing Corporation
Mt. Clemens, Mich.
NBAA Rep: Fred G. Richardson, Jr.
Company operates: DC-3, *Navion*

Kirsch Company
Sturgis, Mich.
NBAA Rep and Chief Pilot: Max L. Partridge
Company operates: deHavilland *Dove, Bonanza*

Rollins, Burdick and Hunter
Chicago, Ill.
NBAA Rep: Wm. R. Vance
Company operates: Bonanza, Navion

Horton & Horton
Fort Worth, Texas
NBAA Rep: DortheAnne Horton

Anderson Aircraft Radio Company
Detroit, Mich.
NBAA Rep: D. R. Anderson

International Aviation Industries, Inc.
White Plains, N. Y.
NBAA Rep: W. E. Nichols
Company operates: two Cessna 310's, a Cessna 180, a Cessna 170 and a T-50.

Wilcox Electric Company, Inc.
Kansas City, Mo.
NBAA Rep: Jay V. Wilcox
Company operates: Beech B-50 and a C-50

Chamberlain Aviation, Inc.
Akron, Ohio
NBAA, Rep: Jack W. Hale

Piedmont Aviation, Inc.
Winston-Salem, N. C.
NBAA Rep: R. S. Northington
Company operates: DC-3, Beech *Twin Bonanza*, Piper *Apache* and Beech *Bonanza*

Dayton Aviation Radio & Equipment Corp.
(Dare, Inc.) Dayton, Ohio
NBAA Rep: Elliott Polansky
Company operates: Beech *Bonanza* A-35

Cluett, Peabody & Co., Inc.
White Plains, N. Y.
NBAA Rep and Chief Pilot: Ernest G. Marquis
Company operates: two Lockheed *Lodestars*

Woodward Governor Company
Rockford, Ill.
NBAA Rep and Chief Pilot: M. V. Bender
Company operates: Beech D18S, Piper *Apache*, Beech *Bonanza* C-35

Besser Co.
Alpena, Mich.
NBAA Rep: P. M. Park
Company operates: Beech Super-18

Burroughs Corporation
Farmington, Mich.
NBAA Rep and Chief Pilot: Donald G. MacDonald
Company operates: Learstar 18

The Gerstenlager Company
Orville, Ohio
NBAA Rep: Marshall McDowell
Company operates: Aero Commander and a Stinson 165

The Oliver Corporation
Battle Creek, Mich.
NBAA Rep: J. R. Mohlie
Company operates: two *Aero Commanders*

American Liberty Oil Co.
Dallas, Texas
NBAA Rep: T. L. Wynne, Jr.
Company operates: DC-3

Black Clawson Co.
Hamilton, Ohio
NBAA Rep and Chief Pilot: Stephan A. Donegan, Jr.
Company operates: Cessna 180 and 310

Goodyear Tire & Rubber
Akron, Ohio
NBAA Rep: Ben Swineford
Company operates: four Lockheed *Lodestars* and a Beech D18S

Embry Riddle Company
Miami, Florida
NBAA Rep: Mrs. Isabel McKay
Company operates: two Stinson 108's, a Cessna UC 78 and a 170

Pilots Employment Agency
Teterboro, N. J.
NBAA Rep: Edward S. Bender
Company operates: a Piper *Apache*, a Porterfield

Safe Flight Instrument Corp.
White Plains, N. Y.
NBAA Rep: K. R. Duee, Jr.
Company operates: a DC-3, a Beech D18S and a Cessna 170

Howard Aero Service, Inc.
San Antonio, Texas
NBAA Rep: D. U. Howard

Potter Aircraft Service, Inc.
Burbank, Calif.
NBAA Rep: Charles A. Potter
Company operates: two *Navions*

Standard Products Co.
Cleveland, Ohio
NBAA Rep and Chief Pilot: William E. McMurray
Company operates: Beech D18S

FUELS-OILS

Features and Facts Pertinent to Successful Flight Operations

Business Aircraft Now Top Aviation Fuel Market

Just in case operators of business aircraft have thought that the line at the fueling pits was getting longer every year —they're absolutely right!

Business aircraft, 21,500 strong the last time a survey was completed (a year ago), have become major users of the nation's aviation fuel supply. Last year, for instance, business aircraft users spent the impressive total of $116,000,000 on the petroleum products that keep the planes flying. That figure, it has been estimated, was a husky 28% of the total bill at airports throughout the nation.

Jet Age Fuels Reviewed: What and Why They Are

No one now, of course, can doubt that the jet age has climbed out of the severe "offices" of military planes and into the flossier furnishings of commercial and even executive aircraft.

In hopes of providing a useful checklist for the jet age, SKYWAYS is presenting here a fuel-by-fuel knockdown on specifications. (Unless otherwise noted or obvious, the figures given are maximums.—*Editor*)

JP-1

This is a kerosene-type fuel. Its government specification number is MIL-F-5616, Amd. 1. Its NATO symbol is F-33.

Here are the key U.S. Government specifications:

Specific Gravity is 0.850 (Avgas, for comparison, runs 0.71).

Freezing Point is minus 76°F.

Flash Point is a minimum of 110°F.

Reid Vapor Pressure, although not actually a part of specifications, is reported negligible in typical production samples at 110°F. (For comparison, gasoline builds up a pressure of some five-and-a-half to seven pounds per square inch at that temperature)

Final Boiling Point is 572°F.

Distillation figures for the fuel show that 10% is evaporated at 410°F and 90% at 490°.

Residue-Loss percentages are 1.5-1.5.

Sulphur (lamp) is 0.20% of weight.

Sulphur (mercaptan) is 0.005%.

Corrosion (copper strip): should "pass" but there are slight variations in test methods that should be consulted in the Government specification lists.

Gum (existent) is 5 mg/100 ml with, again, slight variations in government test methods.

Gum (accelerated) is 8 mg/100 ml.

Water Tolerance is 2.0 ml.

Aromatics, in volume percentage, are 20.0.

Bromine Number is 3.0 cg/gm.

Color (Saybolt) number is a minimum of plus 12.

Kinematic Viscosity, at minus 40°F is 10 cs.

This fuel, JP-1, was the first of the low freezing point kerosene types that powered the early jet planes. Engine-starting difficulties at low temperatures and availability problems cut short its career.

JP-1B (AVTUR)

This is a kerosene-type fuel. It carries a British Ministry of Supply specification number: D. Eng. R.D. 2482, Amd. 1. Its NATO symbol is F-33, serving in that military set-up in the same capacity as the U.S. specified JP-1 regular.

Specific Gravity is not limited but is merely required to be tested and noted. Actually, it is reported to work out at between a minimum of 0.795 and a maximum of 0.825.

Freezing Point is minus 40°F.

Flash Point is a minimum of 100°F.

Reid Vapor Pressure is not written into the specs but is reported negligible at 100°F.

Heat of Combustion in terms of minimum btu's per pound is 18,300.

Distillation figures show that 20% is evaporated at 392°F.

Final Boiling Point is 572°F.

Residue-Loss percentages are 2.0-1.5.

Other specifications, where given, are:

Sulphur (lamp), in percentage of weight, is 0.20.

Corrosion (copper strip): pass.

Gum (existent) is 6mg/100 ml.

Water Tolerance is 2.0 ml.

Aniline-Gravity Product is a minimum of 4,200 but there is a slight variation in the test method used in the government specifications and these must be referred to separately.

Aromatics, in percentage of volume, are 20.

Kinematic Viscosity at zero degrees F. is 6 cs.

Neutralization number is 0.10 mg KOH/gm.

JP-2

To explain the absence of this designation from most specification tables, it should be pointed out that JP-2 was an experimental product that was not adopted for general use.

JP-3

This is a high-vapor-pressure type fuel. Its specification number is MIL-F-5624C and it has not received a NATO symbol.

Specific Gravity is from a minimum of 0.739 to a maximum of 0.780.

API Gravity is from min. 60.0 to max. 50.0.

Freezing Point is minus 76°F.

Flash Point, although not written into the specifications, is reported typically at minus 40°F. It is down to this range, that is, that vapors capable of flashing (rather than burning) will be associated with the fuel. This flash point of minus 40° is identical with typical aviation gasoline specifications.

Reid Vapor Pressure is from min. of 5.0 pounds per square inch to max. of 7.0 psi. Again, this is roughly the same as regular avgas.

Heat of Combustion, in terms of minimum btu's per pound, is 18,400.

Distillation figures show 20% evaporates at 240°F, 50% at 350°F, and 90% at 470°F.

Residue-Loss percentages are 1.5-1.5.

Other specifications, where given, are:

Sulphur (lamp), in percentage of weight, is 0.40.

Sulphur (mercaptan), same basis, is 0.005.

Corrosion (copper strip): must pass but there are slight variations in test methods and specifications must be referred to.

Gum(existent) is 7 mg/100 ml.

Gum (accelerated) is 14 mg/100 ml.

Aniline-Gravity Product is a minimum of 5,250.

Water Tolerance is 1 ml, but there are variations in the test methods used.

Aromatics, in percentage of volume, are 25.0.

Olefins, in percentage of volume, and which may be reported as Bromine Number when specified by a procuring service, are 5.0%.

Smoke Volatility Index is a min. of 54.

Oxidation Inhibitor content can be up to 1.0 pounds per 5,000 U.S. gallons.

Metal Deactivator content can be up to 2.0 pounds per 1,000 barrels of fuel.

This fuel, JP-3, is the grade that superseded JP-1 because of increased availability and better low-temperature starting characteristics. Its handling characteristics generally have been regarded as almost identical with those of aviation gasoline.

From the specifications, however, one obvious disadvantage shows plainly: its high vapor pressure and consequent susceptibility to fuel tank vent losses.

It has the boiling quality of gasoline and the foaming nature of kerosene. Together, these qualities seem to cause greater losses than either avgas or kerosene alone, particularly during high-rate climbing. Not only does this loss occur through straight vaporization but some liquid fuel also is caught in the vapor stream and vented along with it.

An idea of the availability factor that may have outshone all other considerations when this fuel came along as a replacement for JP-1 is the fact that although only about 15% of a crude oil lot can be made into kerosene, some 50% can be turned

nto a "wide cut" fuel such as JP-3.

JP-4

This is a low-vapor-pressure type fuel. ts specification number is MIL-F-5624C, s is JP-3's. Unlike that fuel, however, JP-4 as a NATO symbol, F-40.

Its major specifications are:

Specific Gravity is from a minimum of .751 to a maximum of 0.802.

API Gravity is min. 57.0; max. 45.0.

Freezing Point is minus 76°F.

Flash Point, although not actually a part f the specifications, is reported typically o be from minus 25° to minus 18°C (Note: Centigrade, not F.)

Reid Vapor Pressure is from a minimum f 2.0 pounds per square inch to a maximum of 3.0 pounds per square inch.

Heat of Combustion, in terms of minimum btu's per pound, is 18,400.

Distillation figures show that 20% is evaporated at 290°F, 50% at 370°F, and 90% at 470°F.

Residue-Loss percentages are 1.5-1.5.

Other specifications are:

Sulphur (lamp), in percentage of weight, s 0.40.

Sulphur (mecaptan), in percentage of weight, is 0.005.

Corrosion (copper strip): should pass, but there is a slight variation in test methods and the government specifications should be consulted.

Gum (existent) is 7 mg/100 ml.

Gum (accelerated) is 14 mg/100 ml.

Water Tolerance is 1 ml, but there is some variation in test methods used.

Aniline-Gravity Product is a minimum of 5,250.

Aromatics, in percentage of volume, are 25.0.

Olefins, which may be reported as a Bromine Number is specified by the purchaser, are 5.0% of volume.

Smoke Volatility Index is a minimum of 54.

Oxidation Inhibitor content can go up to one pound per 5,000 U.S. gallons.

Metal Deactivator content may be up to two pounds per 1,000 barrels of fuel.

Thanks to its lower losses through vaporization, this fuel generally was a replacement for JP-3. Its availability is not quite as great but is and has been considered adequate. It has been standardized for practically all military aircraft.

JP-4B
(AVTAG)

This also is a low-vapor-pressure fuel. It has a British Ministry of Supply specification, D. Eng. R.D. 2486, Issue 2. Its NATO symbol is the same as JP-4, F-40.

Here are its major specifications:

Specific Gravity is from a minimum of 0.751 to a maximum of 0.802.

API Specific Gravity is min. 57.0, max. 45.0.

Freezing Point is minus 76°F.

Flash Point, not part of specifications, presumably is equivalent to the minus 25° to minus 18°C. reported for straight JP-4.

Reid Vapor Pressure is from a minimum of two pounds per square inch to a maximum of three psi.

Heat of Combustion, in terms of minimum btu's per pound of fuel, is 18,400.

Distillation figures show that 20% is evaporated at 290°F, 50% at 370°F, and 90% at 470°F.

Residue-Loss percentages are 1.5-1.5.

Other specifications are:

Sulphur (lamp), in percentage of weight, is 0.40.

Sulphur (mercaptan), in percentage of weight, is 0.005.

Corrosion (copper strip): must pass.

Gum (existent) is 7 mg/100 ml.

Gum (accelerated) is 14 mg/100 ml.

Water Tolerance is 1 ml.

Aniline-Gravity Product is a minimum of 5,250.

Aromatics, in percentage of volume, are 25.0.

Bromine Number is 5.0.

Neutralization Number is 0.10 mg KOH/gm.

Olefins, which also are represented as Bromine Numbers, are 5.0% of volume.

Smoke Volatility Index is a minimum of 54.

Oxidation Inhibitor content may be up to one pound per 5,000 U.S. gallons.

Metal Deactivator may be up to two pounds per 1,000 barrels of fuel.

JP-5

This is a high-flash-point kerosene-type fuel. Its specificationn umber is MIL-F-5624C. Its NATO symbol is F42.

Here are its principle specifications:

Specific Gravity is a minimum of 0.788 to a maximum of 0.845.

API Gravity is min. 48.0 to max. 36.0.

Freezing Point is minus 40°F.

Flash Point is at a minimum of 140°F.

Reid Vapor Pressure is not in the specifications but is reported to be "nothing" at 100°F.

Heat of Combustion, in terms of minimum btu's per pound, is 18,300.

Distillation figures show that 10% of the fuel is evaporated at 400°F.

Final Boiling Point is 550°F.

Residue-Loss percentages are 1.5-1.5.

Other specifications of the fuel are:

Sulphur (lamp), in percentages of weight, is 0.40.

Sulphur (mercaptan), in percentages of weight, is 0.005.

Corrosion (copper strip): should pass but there is a slight variation in the test method that should be noted in the specifications.

Gum (existant) is 7 mg/100 ml.

Gum (accelerated) is 14 mg/100 ml.

Aniline-Gravity Product is 4,500.

Aromatics, in percentage of volume, are 25.0.

Kinematic Viscosity at minus 30°F is 16.5 cs.

Olefins, which may be reported as a Bromine Number, in percentage of volume, are 5.0.

Smoke Point minimum is 20.0 mm but there is a slight variation in testing method that should be noted in the specifications.

Oxidation Inhibitor content may be as much as one pound per 5,000 U.S. gallons.

Since its introduction to the fuel family several years ago, this grade, JP-5, has been virtually limited to naval operations.

It is interesting to note that for much of the world's crude oil production, batches that can produce this high a grade of kerosene without expensive refining operations are limited. Yet it has been observed that in this country even some typical domestic kerosene comes quite close to the JP-5 mark, an encouraging comment upon the grades of crude oil with which American petroleum engineers have to work.

JP-5B
(AVCAT)

This is a high-flash-point type fuel. It carries the British Ministry of Supply specification number D. Eng. R.D. 2488 and has the same NATO symbol, F-42, as U.S. specified JP-5.

Here are its major specifications:

Specific Gravity is 0.780 minimum to 0.850 maximum.

Freezing Point is minus 40°F.

Flash Point is 140°F.

Reid Vapor Pressure is not in the specs but has been reported to be "nothing" at 100°F.

Heat of Combustion, in terms of minimum btu's per pound of fuel, is 18,300.

Distillation figure shows that 10% of the fuel is evaporated at 410°F.

Final Boiling Point is 550°F.

Residue-Loss percentages are 1.5-1.5.

Other specifications are:

Sulphur (lamp), in percentage of weight, is 0.40.

Sulphur (mercaptan), in percentage of weight, is 0.005.

Corrosion (copper strip): must pass.

Corrosion (lead/copper strip) is given an index number of 4.

Gum (existant) is 10 mg/100 ml.

Gum (accelerated) is 20 mg/100 ml.

(In both of the gum specifications there is a slight variation in test methods for which the Ministry of Supply specification sheets should be consulted.)

Water Tolerance is one ml.

Aromatics, in percentage of volume, are 25.0

Bromine Number is 3 cg/gm

Kinematic Viscosity at minus 30°F is 16.5 cs.

Oxidation Inhibitor content may be as high as one pound per 5,000 U.S. gallons.

Hewitt-Robins In-Flight Fuel Hose Is Announced

Of all the jobs a section of fuel hose may be called upon to do, the business of transferring fuel from one plane to another, in flight, presents the most impressive problems. The hose can be suddenly stretched and burst, or it can be crushed. And, all the time it is in use it is swishing through the air at speeds and heights not usually associated with the corner filling station or the airport apron.

Hewitt-Robins, hose manufacturers of Stamford, Conn., have taken these factors into consideration in designing a new in-flight hose that the company has placed on the market, mainly as an item of Air Force and Navy equipment.

The new hose has a synthetic rubber tube in its center. This tube, in turn, is reinforced by high tensile-strength wire. Over it all is an outer covering made of oil resistant neoprene.

NAVICOM

(*Continued from page 22*)

while circling. All witness reports and subsequent investigation indicated that normal power was being applied to both engines and no radio contacts were made indicating any trouble.

Prior to take-off in Texas, the pilot had indicated by his remarks to the weather briefer that he planned to make a descent (IFR or VFR not specified) prior to Washington and proceed VFR to Baltimore. The CAB Board analysis deduced from the location of the crash with respect to the radio facilities involved that the pilot abandoned the route specified in his cancelled IFR clearance (which ironically offered reported ceilings of 6,000 to 7,000 ft, over low terrain), and maintained approximately the same general track of about 25° that brought him up Red 77 from Greensboro to Lynchburg. Whether he attempted VFR descent through breaks from VFR-on top condition, or deliberately descended on instruments in violation of CAR, is unknown. The airspace from Lynchburg up to and including the crash site is controlled airspace (Victor Airways 143 & 140). The enroute minimum altitude for instrument conditions for this portion of his track was 6,000 ft and 5500 ft respectively.

Assuming that the pilot knew his location when he left Lynchburg, barring the improbability of a radio failure or other emergency condition, all reasonable evidence led the Board to believe that the pilot relaxed his navigational vigilance while negotiating descent, possibly believing he was over the aforementioned Red 37 low terrain, and was most likely actually navigating by the Victor airway facilities while thinking in terms of the Low Frequency terrain (3,000 ft is a safe altitude after overheading Gordonsville northeast-bound). Circling maneuvers around flood-lighted structure tend to confirm this state of confusion.

Moral—How often do you fly LF Airways by reference to VHF facilities, as in bad static conditions, for instance? Or resort to ground contact navigation in marginal or intermittent IFR conditions?

The second accident occurred when an airline DC-3 crashed during an instrument descent to the Berlin, New Hampshire Airport. Fortunately, the captain lived to tell the story, although the copilot and a company Flight Superintendent riding jumpseat died.

In this instance, the flight was cleared IFR "to cruise at 8,000 ft," the enroute minimum from Laconia, New Hampshire, "for an approach" to the Berlin Airport via Blue Airway 63. Berlin weather was reported as "2300 scattered, 3,000 overcast, visibility 2½ miles, light snow showers, etc." This was close to the Berlin minimums of 2300 ft ceiling and 2 miles visibility. This was last contact with aircraft.

(Several interesting sidelights to the incident include the fact that weather approximately 15 minutes later, probably about the time of the crash or immediately after, dropped somewhat below the minimums. Also, some weak radio transmissions were heard from the aircraft the following morning [weather hampered search activities until the second day] indicating the aircraft was down approximately five miles northeast of the field. This is in accordance with the Captain's subsequent explanation that he thought he had passed the station northbound due to a premature reversal of his ADF! However, the DC-3 was observed by another aircraft flying on top of the clouds to descend into the undercast at about 6,000 ft fairly competently computed at a point well south of the Berlin radio beacon.)

The captain subsequently testified that he interpreted his clearance "to cruise 8,000 ft" as meaning that he could descend from 8,000 ft before overheading the Berlin ADF beacon, and even go as low as 5,000 ft before starting the approved shuttle track for descent, initial and procedure turn within ten miles north of the station.

The term "cruise" rather than "maintain" is used in air traffic clearances to signify that descent may be commenced at the pilot's discretion. It does not attempt to define the word "discretion." Both the Minimum Enroute Altitude for that portion of the airway south of Berlin and the company's Operations Manual called for 8,000 ft to be maintained until overhead the station northbound. Also, the initial approach altitude called for 8,000 ft, although an on-top condition down to, not 6,000 ft as suggested here, but to 5,000 ft or below might warrant descent in good visibility, and any subsequent IFR descent made on the surveyed shuttle track.

Best indications from both the captain's testimony and the remains of the ADF equipment in the wreck, support the theory that he was executing a straight-in approach descent to the airport with a possible hope of getting underneath before arrival over the facility and the airport, and ahead of rapidly deteriorating weather. He stated that he had visual contact until a few minutes before entering the undercast (evidently through breaks coming up the airway), suggesting that he knew his position, contrary to his premature ADF reversal explanation, when he stated his descent.

Moral, if any—do you ever curtail the execution of a full instrument-approach procedure because of occasional, intermittent ground contact, to save time, to beat falling weather conditions, or go off full IFR procedures without attaining required visibility condition at or before your minimums?

As though to confirm and make doubly impressive the principles outlined above with respect to adhering to full IFR procedures until assured of completely VFR conditions or flight completion, we have just received the CAB report of the American Airlines Convair accident near Springfield, Missouri, last March.

Weather conditions and forecast for Springfield indicated probable instrument minimums and possibly below minimums requiring the flight to pass up this landing.

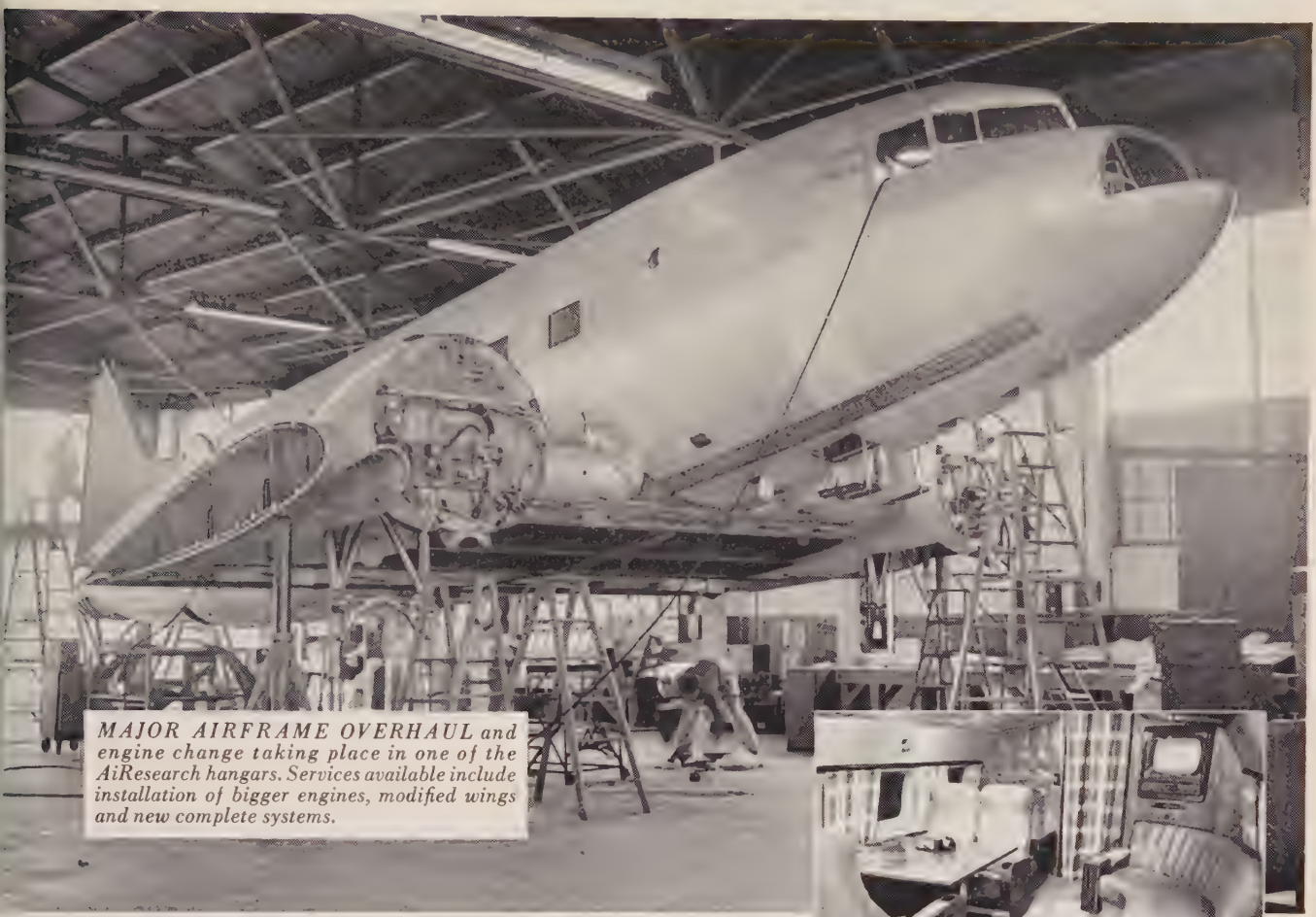
Upon arriving at a point 15 minutes out, the weather was reported as 500 ft overcast and eight miles visibility, very light drizzle with a west wind, adequate for a circling approach in terms of the company minimums and the pilot advised that he would execute approach. The flight estimated over the omni station (the facility being used for the approach) for initial approach at 2233 and reported over at 2234, advising that he was *"proceeding to the field."* Approximately two minutes later, he crashed NNW of the airport.

The airport lies on a track of 193° from the omni station, initial approach for a VOR is the reciprocal heading outbound from the station, 013°, the transition from the airway enroute radial from St. Louis (coming in from the northeast) necessitates a right turn after overheading the station at the minimum enroute altitude (2600 ft) or above subject ATC clearance, to proceed outbound on the 013° track for procedure turn and let-down not below 2300 ft until on track inbound and over the station on final at 1,867 ft prior to final descent to approved minimums, in this case 500 ft above the airport elevation, or 1,767 ft. The elapsed time and the report of "proceeding to the airport" coincident with the first report over the station clearly indicated that full instrument-approach procedure was disregarded in favor of a "straight-in" descent and approach from enroute airway track of 233° to station and 40° left turn towards airport.

Confirming this was the coincident fact that the nearby Air Defense Radar Installation, chose this moment to make a series of radar sequence photos of the area! Visible on pictures is the flight path of Convair and full confirmation that an unorthodox and dangerous procedure was followed.

Conclusion reached by the Board that accident was caused by failure to execute the approved instrument approach procedure under the existent and reported weather conditions.

Every overhaul requirement for your business airplane!



MAJOR AIRFRAME OVERHAUL and engine change taking place in one of the AiResearch hangars. Services available include installation of bigger engines, modified wings and new complete systems.

BEAUTIFUL CUSTOM INTERIOR installed by AiResearch in a Convair 340 owned by the Phillips Petroleum Company. Handsome appointments are combined with practicality.

Let our specialists maintain your business airplane in top condition. Experienced mechanics provide every aspect of aircraft servicing, from thorough 100-hour checks to complete modernization. AiResearch is the only company at Los Angeles International Airport with CAA approval for annual relicensing of your airplane.

A complete engineering department, the finest interior stylists and superb craftsmanship assure you of top quality if your problem is comfort, speed, range, payload, power or all five.

Try our rapid and efficient turn-around service!

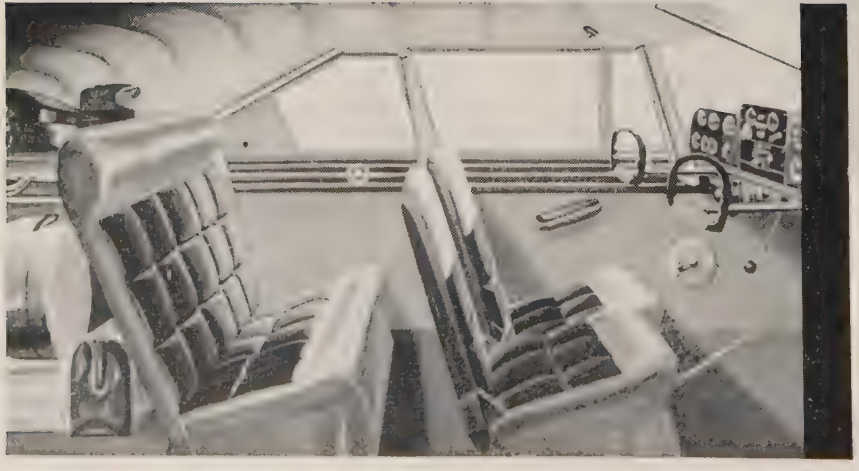
TYPICAL AIRCRAFT WE HAVE MODIFIED OR OVERHAULED:
Douglas DC-3, Super DC-3, DC-4, DC-6 and A-26 — Convair 340 — Lockheed Lodestar — North American B-25 — Martin B-26 — Beechcraft

NEW RADIO AND ELECTRONICS CENTER has most complete facilities in the nation for business aircraft. CAA certified for Class I and II

THE GARRETT CORPORATION

AiResearch Aviation Service Division

Los Angeles International Airport, Los Angeles 45, California



COMFORT AND ELEGANCE of the quiet, sound-proofed cabin make Tri-Pacer travel a pleasure. For added room, rudder pedals and panel have been moved forward and front seats can be adjusted fore and aft separately to suit individual requirements. Deeply upholstered seats, double heaters fore and aft, and five separate fresh air ventilators assure passenger comfort. Separate front and rear doors are an exclusive Tri-Pacer feature.

Art of Smooth Flying

(*Continued from page* 11)

ratio, arrive at *Propeller RPM* or *other-than-those-two* frequencies.

An executive pilot can "phase" his propellers to reduce vibration by simply varying the RPM of one engine while monitoring the vibrometer. He can also change the RPM of both engines to minimum vibrations—and often 10 RPM will produce remarkable smoothness and quiet.

For the executive pilot, the reed vibrometer will indicate an engine malfunctioning long before he can feel it and before the engine begins to shake in its mounts.

The reed vibrometer will give the executive passengers in the cabin a smooth and quiet ride and allow them to arrive at their destination in a completely rested condition.

It will reduce metal fatigue due to vibration, and if a propeller is out of balance, the reed vibrometer will indicate that.

The reed vibrometer justified its existence in its original use when Doc Savage and Gene Grindle introduced it to the Pacific airlanes for in-flight troubleshooting, but its extras open a new vista to the executive pilot.

From now on, the bumpy ride in that noisy DC-3 or any other war-weary aircraft can be turned, by comparison, into a 707 hop or a *Viscount trip.*

Lost Nation

(*Continued from page* 13)

when the air was filled with students shooting one landing after another. They like the idea of having top-notch corporation-aircraft pilots and perfectly maintained planes flying overhead, instead of beginners in overworked fabric ships.

Actually, the neighborhood feeling was pretty well summed up in an editorial in the Willoughby *News-Herald*, shortly after the official ribbon-cutting for the runway. Headed "Pleasant Surprise," it recounted Lost Nation's progress toward its present position as "one of America's safest small airfields" and pointed out the field's role as a taxpaying operation rather than a tax-supported one. "Lost Nation has come a long way in the past eight years under General Aviation, Inc.," the editorial concluded, adding that McNeely's work "has brought a safe, convenient and valuable field to a community which needs it."

The companies in the project are pleased, too. With the field operated by a private business rather than city government, they get service of a high order, and at the same time the feeling that their business is really appreciated.

Business aviation, the group McNeely has been aiming at ever since he began managing Lost Nation, can and does give a well-earned round of applause to this forward-looking operator. Bill McNeely has turned an ordinary grass field into an outstanding service stop for business flights, and a vital part of his community. There are others around the country who should do the same thing.

Round Table

(*Continued from page* 16)

barnacles are accumulating and are cutting into the effective use of aircraft. We are all aware of the work being done in aerodynamic clean-up programs on basic airframes."

Til Peabody: *"I am sure Aero Design & Engineering has met the problem with a positive program of weight control, aerodynamic clean-up, reduction of drag and accessory load in order to make more power available for airplane performance."*

George T. Pew *(Chairman of the Board, Aero Design & Engineering):* "As others have stated, when we build an airplane and the customer takes it, we lose control of it. We can't control the barnacles that were mentioned after the airplane leaves our facilities. Since the establishment of Aero Design & Engineering Co., we have maintained a constant program of attempting to clean up our basic airplane, and a number of things have been accomplished in this respect. One thing, we have lessened the drag of our nacelle. Although we now have a greater frontal area in the nacelle of the Model 560A *Aero Commander* than we had in the nacelle of the Model 560, our present design is more symmetrical and has fewer irregularities and, therefore, causes less total drag. Something on this order might be done, after some study, with the older airplanes.

"The use of augmentation is a subject that hasn't been gone into far enough. There is still room for a reduction of cooling drag with the proper use of augmentation. As Bill Wiseman of Continental mentioned, a properly designed augmenter utilizes only the amount of power for cooling that is necessary under the given operating conditions.

"As weight is added by radio equipment, heaters, etc., the amount of horsepower needed just to hold the airplane in the air increases, and 'excess' horsepower for climb, cruise, etc., is lessened. The only way performance can be regained is by reduction of the protuberances on the aircraft by cleaning up the general aerodynamic lines."

Til Peabody: *"Hal, what is the operator's viewpoint on this matter of adding barnacles which tend to increase drag, thereby reducing the horsepower available for the* performance of the aircraft?"

Hal Henning: "In many instances the airplane manufacturer is so engaged in his own engineering design and the performance of the aircraft that he overlooks the use to which that aircraft is going to be put. I would suggest that the airframe manufacturer work more closely with the operator. He should find out his requirements and then equip the airplane to meet them, using the same inspired design work to keep the barnacles off. In that way the operator would not have to add barnacles after he takes delivery of the airplane from the manufacturer."

Til Peabody: *"Let's get at least a partial answer to that from the manufacturer."*

George T. Pew: "I would appreciate the operators giving us an opportunity to help. There are quite a few things that can be done. These are all compromises, but at least they are reasonably good compromises, for instance, in the installing of antennas, airscoops, etc.

"The normal procedure is for the airplane buyer to just install equipment without giving any particular thought to its effect on the performance of the airplane itself."

Hal Henning: "I agree in the sense that the owner doesn't take such things into consideration, but the only reason he doesn't is that he hasn't the engineering talent and he is faced with the proposition of having to go into a congested area or having to provide sufficient heat for his passengers, or supply a self-service galley. It's a very real problem to the pilot. He has to keep the boss satisfied because he is the one shelling out the money. Therefore, the pilot goes ahead and does the best he can, but he isn't an engineer."

George Pew: "I wish they would come to us more often. We might be able to help with the problem."

Ralph Harmon: "I would like to point out that these are all compromises. We have to consider who is making the compromise, the manufacturer or the user. When the shoe is on the user's foot, the compromise may look as though it belonged on the manufacturer's side. This whole thing is a transitional problem that is with us continually, and I think that we, as manufacturers, do the best job we can. But the problem always will be with us."

Til Peabody: *"The operator has a group of problems that stem primarily from the demands of the one who is paying the bills. One of our operators here has had considerable experience with satisfying the demands of the boss and which have resulted, no doubt, in weight compromises.*

"Mike Murphy, will you tell us why we have to make these weight additions?"

Mike Murphy *(Mgr., Aviation Dept., The Ohio Oil Co.):* "Til, I'm certainly in accord with everything that has been said thus far. I do think that we users of corporate aircraft understand some of the manufacturer's problems, but I wonder if the manufacturer explores the various aids that are necessary on his aircraft if it is to be operated in the highly congested areas. We know that most all of our ships are flying with big ADF loops on them and we have to have ram horns out there, but shouldn't the manufacturer have foreseen the need for these various aids and provided the aircraft engineering to take care of them?

"So far we have mentioned power for speed and the power it takes to pull the additional load on the aircraft, but there has been no mention of the power it takes to drive these various accessories. In my figures I have always assumed that on a twin-engine airplane about 50 horsepower is sapped from each engine to drive generators to furnish the electrical power, to drive our various heaters, operate radios, etc.

"The corporate operator has only three things to sell: time, comfort and safety. Trips in our company aircraft are more far-reaching today than they ever have been. We are nearing the point where we must have an airplane that travels at a high rate of speed for long distances, but still will perform on a single engine. To me, that is a big factor. I wonder whether

not installing additional equipment to pply the power to drive the various navitional aids, the heaters, etc., is a pracal solution inasmuch as it adds weight. so, if the drive-source is a petroleumwered affair, it probably would add anher fire hazard to the aircraft. I would e to hear more about how we can save e amount of horsepower we have rather an use it up driving these aids."

l Peabody: *"Ralph Harmon has an idea that."*

alph Harmon: "We propose to accomish that by employing an auxiliary powerant to handle the various chores. While e auxiliary powerplant becomes another em to be maintained, its maintenance is ncentrated in a specific area and it is ficiently designed to do a job which, the past, has been an after-thought."

ill Wiseman: "Speaking from an engine anufacturer's standpoint, it is not an ter-thought. At the inception of any enne design, we have to take into account l the accessories that engine will be reuired to drive as well as those that might e added at a later date. The concept remote accessory power is not a new ne. It has been kicked around for a good any years, but no one has come up with practical solution. A cost analysis would ow that the accessory drives and power ke-offs that go into an engine are done at a considerable cost increase to the gine manufacturer. The reason is that most cases you are dealing with drives at are compromised in their location, d they usually are connected with some her more expensive part such as a crankse. We can show that in a small 200- 300-hp engine, in order to meet the mplete AN specification, the back or cessory area of the engine is disproporonate to the size of the rest of the enne. This is not so true on the larger gines. After the accessory section is uilt into an engine, then we duplicate the hole thing in every other engine we put to the installation. I firmly believe that all of these, or as many as possible, were moved from the engine and put into a parate unit designed specifically for what has to do, there would be considerable vings in both cost and space, and there ight even be a saving reflected in the oling-drag problem insofar as the size the engine and the size of the nacelle e concerned. The installation would profit putting accessory drives into a unit by self."

il Peabody: *"Then there are means by hich we can make our present horsepower ore efficiently available for the performnce of the aircraft."*

erbert H. Bowie *(Sales Representative, ycoming Div., AVCO.):* "This concept of separate auxiliary power unit is very od. Though auxiliary power engine acssory pads on present engines are a real roblem, they become even more of a probm on turboprops in the same power class. "We have found that on turboprops, here both engine size and weight are drasally reduced, accessory drives and pads n become the major part of the engine less steps are taken to keep them at a inimum. On our new turbine designs ery attempt is being made to keep only sential engine accessories on the engine. One heavy-duty drive is provided which can be used for one airframe accessory, or can be used to drive a separate accessory gear box. Thus, the accessories can be located out of the engine nacelle and buried where they have no effect on airframe drag."

Til Peabody: *"You probably would find the idea very acceptable to the operator down the road, but in our case we are operating aircraft in which we have not as yet met that problem.*

"A fairly reasonable percentage of all business-aircraft operators are operating on what I chose to call 'surplus horsepower.' In fact, I think business air transportation got a substantial start because of the availability of low-cost surplus engines. Quite possibly most of these currently operating DC-3's are doing so on surplus horsepower. The question now is, how long can we reasonably expect the supply of surplus engines and parts to last at the present and projected rate of use?"

Paul Martin *(Sales & Service Mgr., Steward-Davis, Inc.):* "Having operated an engine overhaul shop for close to 10 years, we have given considerable thought to the problems brought out here. Many modifications have been made to surplus aircraft in the hope of increasing performance, and while we feel these modifications are noteworthy, we also feel there remains much to be done in cleaning up existing aircraft. The powerplants used for aircraft such as the *Lodestar*, the DC-3, and

the PV's were powerplants that were available at the time the aircraft were built. Since then, however, other powerplants have become available, and we feel that the combination of other powerplants plus the cleaning up of the present aircraft configuration will offer a lot more performance to executive-aircraft operators than they have had thus far.

"In most cases the engines we are using today were built during the war. We think there is much that can be done to those powerplants to perfect them, to add horsepower to them, to modernize them and come up with other configurations that will benefit present-day aircraft. We talk about cleaning up aircraft to get more out of them, but that is only a part of it. There is a lot yet that can be done with the available surplus engines to better or to at least bring back the performance that aircraft had before all this extra weight was added in the form of antennas, radios and all the other items which take away from performance.

"The ability of the R1830-94's to bring the performance of a DC-3 up to CAA Transport Requirements while increasing gross load to 26,900 lbs shows what can be done. Thus, we feel performance can be regained through engineering and research on the powerplant itself.

"As far as the availability of existing powerplants is concerned, there are two or three that currently are being used on business aircraft that are scarce. However, there are other enginess that can replace these scarce ones, and they will offer even better performance. With the existing stocks throughout the country and with the military releasing more surplus, there is no shortage and there won't be any for the next five to eight years. In that time we hope the manufacturers will come out with turboprop and turbojet engines.

"There also are auxiliary power units available that will increase the performance of business aircraft. We as an organization are working on something now which can be used either as an auxiliary power unit for additional thrust or as a power unit to drive accessories. However, we feel that the engines in their present configuration have adequate drives to handle the accessories, so there actually is no advantage to removing these drives and putting the accessories on an auxiliary unit.

"In short, we do not feel there is a critical shortage of good replacement engines and we do feel that by the time a shortage develops, the manufacturers will have come up with something new."

Til Peabody: *"One would guess there is an unlimited supply of surplus powerplants! Frankly, I hadn't realized we built that many engines during the war that were not used. It's probably a good thing because the operator might find that when his supply becomes a little more limited, the cost is apt to go up enough to price some business-aircraft operators out of the market.*

"From an overhaul standpoint, Mr. Gillespie, what has Airwork to say?"

John S. Gillespie *(Vice Pres.—Sales, Airwork Corp.):* "I don't think you can make a general statment about surplus because certain items have been off the market for a long time while others probably will be with us until the junkman comes. However, it does look as though we will have enough parts for the commonly used surplus engines to carry us until the operator is no longer satisfied with that equipment. Actually, I think the determining factor will be that newer production equipment will better meet the operator's requirements, and not that we have run out of surplus parts."

Til Peabody: *"Would you say the operator's dissatisfaction might arise from too-high costs or too-low performance?"*

John Gillespie: "As newer equipment becomes available to do a better job, the operator will feel he should go to that newer equipment."

Til Peabody: *"It is worthy of note that in the surplus field the business-aircraft operator has been buying horsepower at such an extremely low cost, about $2000 for 1200 hp, that when he reaches the transition period and has to pay $32,000 for 1400 hp, he's going to have a substantial economic hurdle to get over. Perhaps before we reach a point of major dissatisfaction over poor engine performance among business-aircraft operators, we might find that the desire for new equipment will stem from the high cost of maintaining the older equipment."*

John Gillespie: "That's true. The cost of maintaining surplus equipment has gone up tremendously and is going up steadily. It increases for two reasons: one is that as certain materials become more critical the price goes up; secondly, as the surplus parts disappear from the market, new production parts must be used in their place. This is further speeded up by the fact that modernization almost always results in substituting factory-new parts for surplus. Therefore, maintenance of your surplus engine goes up to a point where it approaches the factory price of new equipment. Right after the war, you could buy a new 1830 engine for so little that in many cases it was ridiculous to overhaul it."

Art Kuhn: "To elaborate a little on this increase in drag we were discussing, I'd like to point out a few of the problems we encountered.

"For years we thought aircraft in the DC-3 category could be fairly dirty aerodynamically, with little loss in performance. But with the advent of faster aircraft, such as the DC-6 and the *Stratocruiser,* we had to re-educate everyone that had anything to do with these aircraft, particularly the mechanics. A few minutes ago I stated we had regained all the losses in cruise speed by reworking the engine nacelles. Actually, there were other areas we also had to explore, the flaps for example. While they were maintained within the manufacturer's limits from a wear standpoint, they were out of limits insofar as aerodynamic cleanliness was concerned. We found that we had to reduce the manufacturer's limits in order to eliminate the problem of a flap extending upward into the air stream.

"Another item was minor dents in the first 25% of the wing leading edge area. This program became rather involved and so we went to Boeing for assistance. Boeing then established a flat-plate area disturbance criteria for us to determine the loss

e could expect from certain items pro-
uding beyond the boundary layer. For
xample, an outside patch on the first
5% of the leading edge area of a nacelle, a
ing or fuselage will create a given flat-
ate area disturbance. With this informa-
on available, we went to work on the air-
aft and, as a result of this aerodynamic
ean-up, we regained 80% of the speed loss.
"We also took a brand new DC-6 and
stalled four used DC-6 nacelles on it.
/e experienced an 8-mph loss in cruise
peed. However, when those used nacelles
ere sent back to the shop, gone over
inutely, and reworked where necessary,
ie patches removed, etc., and the nacelles
ut back on the -6, we recovered 7 of
iose 8 mph."

'il Peabody: *"Art, you've pointed out
hat we have to be more technical in our
erodynamic clean-up in order to get the
ost effective use of our present horse-
ower. Does anyone have any suggestions
n how we can extend the time between
verhauls and thereby extend the life of
he powerplant?"*

Bill Wiseman: "Again I have to go back
o the flat engines. There was an inter-
sting write-up in one of the recent SKY-
VAYS on additive oils *(August Round
'able)*. We feel that the petroleum in-
ustry has developed oils and lubricants
or engines that offer considerable advan-
ages to the engine users. An engine of our
ype has to qualify for CAA approval on a
pecified type of oil, and in all cases we've
sed a straight mineral oil. If we chose to
o to an additive oil or a detergent type,
he qualification of the engine and the sub-
equent use of that engine would be based
n the use of that particular type of oil.
feel there is a real need for a coordinated
rogram, possibly through the oil com-
anies, to establish a type of additive oil
n which we can qualify our engines and
he user can buy under that type name any
lace within the continental U. S. I have
alked to most of the oil companies about
his and I find it's a difficult problem.
'hey all have their own special brands of
il they want to use, but we are restricted
n the use of these new oils because of the
ack of a coordinated program to make
hese oils available to us."

Herb Bowie: "We have encountered the
ame situation at Lycoming. Unfortunately,
here are some additive oils on the market
vhich are not fit for aircraft use. I am
ure that any coordinated program would
liminate those oils and would provide
ie proper additive oils for the light air-
raft market, oils that could substantially
ncrease engine life. Without a coordinated
rogram, the user has no way of knowing
hat oils are satisfactory for aviation use
nd what are not. As Mr. Wiseman pointed
ut, there is no way we can qualify our
ngines for these particular oils."

'il Peabody: *"John, would you mention
ome of the changes the overhaul bases
re making to extend the time between
verhauls of some powerplants?"*

ohn Gillespie: "That is a slow develop-
ent, Til. As weaknesses are discovered,
ther in overhaul technique or in the
esign of certain parts of the engine,
iose weaknesses are corrected and the
fe of the engine is lengthened accord-
gly.

"When we first started overhauling R2000 engines for our airline customers, the normal CAA-allowed time between overhauls was 900 hours. Now all of our airline customers operating R2000's are running them 1600 hours and some have applications in for 1700. Thus, in eight or nine years we have about doubled the allowable time between overhauls."

Til Peabody: *"Perhaps some engine manufacturer will tell us whether or not they are interested in this problem to the extent that they are modifying their engines by using such things as chrome-plated barrels, etc., to extend the time between overhauls."*

Herb Bowie: "We are very interested and we have used chrome barrels. One of the problems we encounter in the small horizontally opposed engines is that chrome-plated barrels and some of the other items increase the cost of the engine to the airplane manufacturer and, therefore, up the basic cost of the airplane. However, if you consider the over-all operation of the aircraft, you will find it pays off because it tends to reduce cylinder wear.

"Also, when cylinder barrels reach a point where they have to be replaced, frequently you can replate them at a much lower cost."

Edwin Jones: *(Pilot-Engineer, Van der Horst Corp.):* "Thanks for the plug, Herb. As you probably know, the Van der Horst Corp. is foremost in this cylinder-plate business, and over the past 25 years we have done considerable research in both Europe and the U. S. The resultant product, Porus-Krome, is one that will increase the life of a cylinder barrel up to 10 times, while simultaneously reducing ring wear and lube oil consumption. We think this is advantageous to the business- or commercial-plane operator in that the time between overhauls can be lengthened considerably. In addition, the length of time during which new-engine performance is realized, is increased considerably."

Bill Wiseman: "One thing important to engine life is this matter of air filters for aircraft. Air filters are many years behind in their effectiveness in protecting aircraft engine life. The type of aircraft that Continental engines power operate in and out of small dusty fields. Dust is an extremely important factor in the life of an engine. In fact, it's a major factor in engine wear. We have one military model, normally a 1,000-hour engine, that has come back to us in quantities after as little as 300 hours of operation, because the cylinder barrels and rings have been completely worn out through ingestion of dust in the engine. We have tried to stimulate activity on the part of the air-filter people, but haven't been too successful."

Til Peabody: *"Can we increase the power output of today's engines? Blackie Martin, are steps being taken to add to the power output?"*

Blackie Martin: "There are certain organizations that are working on engine modifications to increase the output over the original rating of the engines. We, as one, are working on several different model engines, and we do feel that engines in their original configuration can be extensively bettered. The one factor, however,

that has hindered progress in that direction is that an engine overhaul shop normally does not have the engineering personnel to cope with the problem. Also, if a modification is made, you can be sure an overhaul shop has spent several thousand dollars coming up with that modification, and under the existing regulations as set up by the CAA, the overhaul shop can't retain control of the modification work. In other words, unlike most fields, it's possible for an overhaul agency to spend $50 or $100 thousand on a modification, turn out six or eight modified engines, and then have a competing shop obtain one of those engines and copy the modification without being required to go through any of the engineering and research that had to be done originally at so much cost.

"That may be one of the main reasons why the present powerplants actually haven't been developed beyond their original configuration. We of Steward-Davis have gone into that work because we feel that the available powerplants can be improved. We have found deficiencies in engines that we know can be eliminated and the engines thereby improved. It costs a lot of money to go ahead and develop such improvements, but by so doing we feel existing powerplants can offer a lot more to the executive-plane operator.

"All of you are familiar with the CB-16 engine. You may recall Convair's clean-up program on the 340 last year. Benny Howard directed this project, and one of the key improvements was redesigning the cylinder baffles which substantially reduced the cooling drag of the CB-16. These baffles were part of the miscellaneous clean-up work around the nacelles and fillets of the 340 through which Convair picked up about 15 mph. After a little more test work, these baffles will be incorporated as a standard item on the Convair 440.

"Improvements can be made in engine design. We're convinced that if an organization would put enough money and initiative into projects such as Convair's, the performance of the DC-3 could be improved tremendously. There are several conversions and modifications in process, of course, but there is still plenty that hasn't even been tried yet."

Joseph Mashman *(Ass't. Dir.-Contracts, Bell Aircraft):* "Til, the question was, can we increase the available horsepower of our engines? So far the answers have been that we can improve the performance. I'd like to know whether or not we can actually increase the horsepower of present engines? Can we get more shaft power, forget about drag? Can we increase the rating that the manufacturer puts on the engine?"

Blackie Martin: "Yes, we can."

Art Kuhn: "Having formerly been associated with an engine manufacturer, I would be reluctant to say, 'yes,' to that question. Those engines were designed on the basis of research data established by perhaps one of the largest engineering organizations in existence. Certainly, it is considerably larger than all the engine-overhaul agencies combined. The ratings that were established for these particular engines were the result of certain obvious tests, such as detonation and reciprocating forces. As time went on and more horsepower was required, the output of these engines was increased. The 1820, for example, went from its original 450 hp to its present 1525 hp. I am sure that both Wright Aeronautical and Pratt & Whitney have put forth their best efforts in attempting to increase the horsepower output of their engines.

"Pratt & Whitney went through a similar stage of development on the 1830 engine. When the need for a larger engine, specifically for the DC-4, came along, P&W did not feel it was feasible to boost the horsepower output of the 1830, so the R2000 was developed. I am convinced in my own mind that if P&W felt their engines could be increased in horsepower output, that increase would readily be available to us."

E. W. Conlon *(Asst. to Gen. Mgr., Fairchild Engine):* "I agree with Art. We are constantly working to improve the service life of the engines that we overhaul, but we don't feel that any overhaul shop should attempt to increase the horsepwer rating."

Til Peabody: *"Possibly we will find more horsepower in engines that are either in production or planned for production which can be used in today's aircraft to give better performance tomorrow.*

"Do we have any such powerplants which could be used on today's aircraft? It seems to me there are a number of airplane operators who are demanding increased horsepower. Perhaps the helicopter could use more horsepower. Do you wish to comment on that, Joe?"

Joe Mashman: "In our Model 47 series helicopter, we have installed a derated 250-hp Lycoming to replace the former 200-hp powerplant. By derating the engine, merely a manifold pressure derating, we have been able to do two things: 1) increase the performance of the aircraft, at altitude particularly; and 2) increase the reliability of the powerplant. By derating, we don't use the full horsepower available at sea level. Therefore, we feel that we can also increase the time interval between engine overhauls.

"In the helicopter as well as fixed wing aircraft, an accessory load will decrease the power available to the rotor system, and we find that we suffer in helicopter lift performance. Excess horsepower applied to the vertical climb of a helicopter is approximately twice as effective as the equivalent applied to the best rate of climb of a fixed wing aircraft. By derating the engine we conceivably can throw more horsepower onto accessories and we can even install mufflers if the helicopter's exhaust noise is a problem. It will not affect your performance other than just the weight of the additional accessories that you are carrying."

Til Peabody: *I think Lycoming has something to offer on the availability of increased power in new engines."*

Herb Bowie: "Mr. Pew, I believe, is quite familiar with increased airframe performance through increased engine power. We are continuously increasing power on our opposed engines as development permits. On one of our six-cylinder engines we have raised the output of the basic powerplant considerably, and in addition incorporated a geared supercharger yielding a significant power increase for the weight added, and vastly improving altitude performance. This engine, the GSO-480, is now CAA type certificated and in production.

"On the six-cylinder engine we have raised the power of the basic powerplant and in addition have added a supercharger to give us a sufficient power increase for the weight added."

Til Peabody: *"Are you building a larger engine which is usable on the larger twin-engine business aircraft?"*

Herb Bowie: "That's a leading question. Lycoming does build the 1820 engine and also the 1300 under a license agreement with Wright Aeornautical, for both military and commercial use. However, engineering cognizance and commercial sales are still held by Wright.

"Power increases for these engines brings up an interesting situation, particularly when you talk in terms of going back to the manufacturer to have him do the things necessary to bring the engine up to today's state of the art. One minute we talk about executive-aircraft engines costing $2,600 on the surplus market, and the next minute we talk about power increases which would immediately take you from $2,000 to over $25,000. Undoubtedly. the R1820 and the R2000 ratings can be increased in many installations. The question is whether the market is there and whether you can afford such modification."

Robert E. Reed *(Sr. Experimental Engineer-Flight Research, Allison Div. GM):* "There is only one thing that has not been explored as far as increasing power is concerned, and that is the use of different fuels.

'Going back to the 1710, we knew from st experiences that we had an engine could get up to 100 inches of mani-d pressure wet . . . about 1850 hp, I ieve. I have known of an engine in that ne category that used different fuels and nt to 120 inches manifold pressure.

'The only thing you have to contend th today is paying the cost of going o the higher fuels, either to develop or buy. Fuels of that nature are scarce lay, plus the fact that you need a lot of gineering to get the proper blends. From e standpoint of the commercial user, ybe he isn't ready for that maybe he ll have to wait until the military gets n on his feet. Maybe he will have to them absorb the cost. But I do believe at by experimenting with fuels, there is possibility that present-day engines will n at a little higher power."

W. Conlon: "There is another way of creasing the power available in today's planes. The installation of small turbo-s on the wing tips or in any conveniently ated nacelles is an ideal method to aug-ent reciprocating-engine power at a mini-im installed weight and at a relatively v cost. Two of these power packages stalled on a medium-sized twin-engine ex-utive transport (gross weight, 40,000 to ,000 lbs) will produce an increased re-bility and safety approaching that of e four-engine airplane. Flight tests and gineering estimates show that a twin-gine airplane, gross weight of 60,000 lbs, hich has a single-engine rate of climb of 0 fpm, will, with the addition of two 000-lb turbojets, have a rate of climb of 0 fpm.

"This extra power also can be used to crease the cruising speed. Estimates for e twin-engine transport of 40,000 to ,000 pounds gross weight show the addi-n of two 1,000-lb turbojets will increase e cruising speed from 285 mph to 325 ph.

"This power package is easily attached existing aircraft at a minimum cost and high ratio of thrust available to in-lled weight."

l Peabody: *"Augmenting your power by ding a power unit would improve per-mance under specific conditions.*

'We have discussed the more efficient e of existing engines by reducing weight, g and accessory load; we have explored efly the possibility of increasing power our existing engine—and this does not m to be very fertile territory—and we e talked about new powerplants in pro-ction which would give us added power. e R2000 is probably in that category for pecific aircraft.

'Now I think we are ready to hop into crystal ball department. The design new business aircraft is primarily de-mined by the actually planned avail-lity of suitable powerplants. Therefore, 's consider this question of the future. hat are the power requirements of the siness aircraft in terms of desired per-mance?

'George Meyers, do you have any ideas arding this expected performance?"

orge E. Meyers *(Pilot, Monsanto emical Co.):* "We have been in this uggle for more power along with every-e else but, in contrast to this, we are us-ing the 1830-75 and derating it in an effort to accomplish increased overhaul periods and safer operation.

"Obviously, we are going to need more power and we are going to need a new airplane, something to meet the requirements of the business-aircraft field. I am certain that within a reasonable length of time, we will be in the turboprop and turbojet field."

Til Peabody: *"What airspeed would you call desirable? This, of course, would determine to some extent the type of powerplant we will have."*

George Meyers: "We were in Washington recently and saw this new four-place MS-760 which Beech Aircraft is demonstrating. The boss looked at it with a gleam in his eye and said that was what he wanted.

"Ten years from now, I would say, we will be operating in the neighborhood of 500 mph."

Til Peabody: *"Mike Murphy, what sort of speeds are you contemplating in this airplane of the future, realizing it would be specifically for the business operator?"*

Mike Murphy: "I'd say 400 mph. Again, speed is what we sell. The $2,000 powerplant we have been discussing here has been useful. After all, it did 'sell' business-aircraft operation by the very fact that it made it possible for us to buy airplanes. Today, however, we are in a position where the boss wants speed as well as comfort. He does not want to be cramped. We looked at this little jet and thought it was a great step forward because only 12 months ago we were not able to fly any of our Board of Directors in a jet airplane. Three months ago we did fly them. However, the practical utility of that airplane does not meet our needs.

"I think I can speak for a major portion of the corporate operators and in their opinion between 400 and 500 mph would be acceptable. The airplane also must offer a reasonable amount of room to move around in. I'd say a 10-place airplane set up to carry from four to six. That sort of airplane would be ideal for us."

Til Peabody: *"Four-to-six place and 400 mph. What desired cruising altitude?"*

Mike Murphy: "I don't think altitude makes any difference. The important thing is that the executives want to get to their destinations and they don't want the weather factor to enter into it. They don't care how high you go as long as they are traveling in comfort."

Til Peabody: *"Hal, within fairly broad limits, what would you say the executive operator expects in his aircraft of tomorrow?"*

Hal Henning: "No one airplane is going to satisfy the requirements of all executive operations. We may have to have two types of air transportation: first class and tourist class. I don't mean tourist class in the sense that it is any less respectful to the passengers. I mean rather that we must go into small fields occasionally in order to serve plants that do not have the advantages of a transport-type field and probably won't have in the foreseeable future. Therefore, we can't talk about one airplane, but must consider three or maybe four types.

"One would be the transcontinental long-range, pressurized aircraft capable of be-

(Continued on next page)

The Flight Was Routine

by Hy Sheridan

Capt., American Airlines

The airline and safety authorities say, "Share the experience," so that is the purpose of this little gem. This was my experience and you can have it all, not just a part of it. It's about ice that does not tinkle, the kind I do not like.

I was flying a DC-6 into Chicago one winter night. We had a stratus overcast, tops about 8500 feet, and Airways cleared us down to 5500 feet. Let me take this opportunity to say that the Airways people in Chicago, including the birds in the glass cage, are marvelous . . . and that's the right word. You know that if they weren't, a cobnutter like me would tell you. I say, a nosegay to 'em.

My first pilot, very modern and therefore inclined to be mechanical but very precise with it, was flying the tin can. We were at the 5500-foot level about five minutes when the old contraption began to shake and shiver like a spinster in a rhumba, and there came a loud whistling, much louder than the sound of the engines. "Dear me," I said to myself.

Usually we can tell by the windshield when we are picking up ice. But the Dizzy Six has duck-proof windshields which are made in two parts, an outer surface and an inner surface which latter is supposed to stop curious ducks.

The reason that we could not see through the windshield was because of the Tyndall Effect. You should know about the Tyndall Effect because it has a very impressive sound, and if you toss it off with nonchalance, your listeners will think you're quite an athlete under the cowlick. Besides, it's important to flying safety.

With the Tyndall Effect you can see things that are invisible, and they may look quite large, too. In everyday experience you are familiar with the Tyndall Effect. When the window curtains are closed and a shaft of sunlight slants into the room, you can see lots of dust particles swimming around. You can see them because of the side lighting. Without it, they'd be invisible.

Now, there is a space between the two windshields through which hot air can be circulated and which is supposed to keep ice off the outside, although it doesn't do much good. Dust particles collect on the interfaces, and an oil fog, too, composed mostly of particles too small to be seen directly. So, without cross lighting the windshield may look all right.

The duck shield has some fastenings which are very difficult to handle, and so the mechanics avoid removing the shield and wiping off the oil fog. The managers and engineers don't know about the Tyndall Effect, so they don't do anything about maintaining this important item. And that's how we got caught!

The cockpit lighting gives a cross light on the windshield, bringing in the Tyndall Effect. In the dim cockpit light the windshield was opaque and we could not see the ice beginning to form. But when I put a flashlight on it, it was easy to see that it was covered by ice—a fact that could not be determined at night by the ordinary cockpit light.

I wasn't on the controls, so I don't know if the rudder had given out with that little sidewise twitch which I suggest be named the Monroe Effect. Anyway, I took a look at the wings. "Isn't that interesting?" I said to myself. The thermal de-icers on the leading edges had transferred the ice back to the lift part of the airfoil.

We had to find some warm air quickly and we had to get out of the icing level. So I called Airways and told them we were going downhill, and if they were interested in which way we were to head, we would be glad to negotiate the matter. They told us which way to point, and they also said the air was warmer below, 39° on the ground.

Our landing visibility was about an eighth of a mile on account of the windshield, but we were used to that, for the runway lights naturally shine sidewise on the windshield particles and cause the Tyndall Effect.

When we checked out at the Flight Office, they asked us how the flight was and we said, "Routine." To say "routine" is routine —and so is the Tyndall Effect. Watch out for it!

Round Table

(*Continued from page* 39)

ing integrated with airline traffic. The second would be the medium-range, 700 miles or so, transport that would offer somewhat better take-off performance than the long-range type. The third might be a smaller type which would be the utility plane serving the smaller out-of-the-way plants that aren't favored with better airports. The fourth could very well be the helicopter. It is becoming increasingly apparent that, as Mike put it, the saving of time is the feature we have to offer. It gains us very little if, after we've flown cross-country for 30 minutes, our passengers have to travel by car for 45 minutes to get to their places of business.

"In the long-range category, we're talking about 400 to 500 mph cruising, seven-to-eight places, 2,000-mile range and pressurized; for the medium-range transport, we're talking in terms of 250 to 300 mph, also seven or eight places, and possibly pressurized. In this matter of pressurization of this type of equipment, the question is whether or not you want to sacrifice the load-carrying performance that you'd have to give up to get pressurization. The answer to that requires a great deal of consideration on the part of all the operators. Certainly, we have to meet on some common ground so that any airframe manufacturer would be justified in going to the expense of designing and building an airplane. The manufacturer has to have a relatively good market to justify such expenditure.

"I believe the aircraft we have today the short-range type that can get into small fields, will be with us for a long time, maybe 20 years. I also feel we are going to be operating these engines that we now have, for the third or so-called tourist-class service for a substantial period. And therein lies one of our major problems—where are we going to get the horsepower to continue this specific operation?

Till Peabody: "*We seem to be discussing aircraft of the future in terms of longer range, higher speed equipment to serve the demands that have been evident in business air transportation, without overlooking the fact that the existing types of aircraft, the light twins and DC-3 types, will be with us for a long time, augmented to a large extent for the close-in work by the shorter range, short-landing and short-takeoff type of equipment, which could be the helicopter and/or various other aircraft which either are under development, in existence or will be developed.*

"*Concerning the long-range, high-speed pressurized plane, what type of power plant can we presume will be available for it?*"

Herb Bowie: "There is a gap here because no one as yet has determined, from the airframe manufacturer's standpoint what power will be required. However, we are continually working with the airframe manufacturers and studying their requirements to see what we can do to keep our development program up-to-date, and provide the power for their future aircraft.

"There are ample powerplants in existence now or being developed which will be available in the near future to cover the needs of the small utility plane.

"Going to the medium-range, we are developing new supercharged engines of 300-to-500 hp which may fall in this category. The GSO-480 rated at 340 hp, which was mentioned previously, is an example of this development. We also are developing a new eight-cylinder, supercharged opposed engine which will be around 500 hp. This engine will offer extremely low drag and specific weight, and will offer some real opportunities for improvement in existing airframe performance as well as the potential for developing new and better aircraft.

"Considerable work is also being done to provide more effective cooling with lower engine cooling drag losses, which also will reflect in improved airframe performance. As an example, we have delved deeply into exhaust ejector cooling systems and now know that we can completely cool an engine in a buried installation such as a helicopter where no ram air is available. Such systems appear very good for executive aircraft and, applied over the entire range where reciprocating engines are used, can reduce drag with little sacrifice in power.

"Lycoming is also developing, under military sponsorship, an 800-hp turboprop which will weight around 500 lbs and be about two feet in diameter and four feet

ong. This engine, the T-53, has been under est for about a year, and will be available n the very near future. One model of the ngine is already scheduled for use in the ew XH-40 helicopter being developed by Bell, and we are currently working on installations in several executive-aircraft designs which would fall in the medium-ange transport category.

"For the long-range aircraft, we are developing another turboprop with considerable more power than the T-53, but only lightly larger and heavier. One airplane already is known to be designed using this urboprop and it undoubtedly will come ery close to meeting the stated requirements. This turboprop is a military development and, unfortunately, I cannot provide nore data at this meeting. However, I can ay that both of these are of the free-urbine design which appears to be best or both helicopters and executive aircraft, nd both turbines incorporate sufficiently igh pressure ratios to insure good specific uel consumption."

Til Peabody: *"Bill, what can Continental contribute relative to the availability of the horsepower to serve the larger and higher speed types?"*

Bill Wiseman: "I believe there are going o be a good many flights scheduled between now and the time we reach this 400- or 500-mph bracket, and they're going o be accomplished with piston engines. I also believe that developments forthcoming in piston engines are going to go a long way toward bridging this gap and making the transition a little less abrupt.

"The opposed engine has a long way to go; it has not reached its peak of development even though its specific outputs of power are now about twice what they started out to be. To indicate briefly how this transition is going to be accomplished, I've listed a number of developments, most of which are very realistic and some of which are reaching out a bit but are definitely possible and will contribute to the extended output of the piston-type engine.

"I'd say the piston engine is going to play a major role in business air transportation for roughly 10 years. In that time, other types of powerplants will be coming in; the turboprop may be along in three to five years.

"But to elaborate a bit on the piston engine, flat engines probably will go up to 500 or 600 hp. There will be an increased use of reduction gears; and the mechanically driven supercharger has not been exploited on all of the small type engines as yet.

"Beyond the mechanically driven supercharger is the turbo-supercharger which will give the engine greater utility at altitudes and greater flexibility for installation in the thinner wing aircraft where you have some choice of location of the turbo-supercharger.

"There are some developments in cylinder cooling, in the art of casting cooling fins, and soon we will have cylinder heads available that are made by the shell-mold process which increases the cooling capacity considerably and can help in reducing cooling drag. There are new developments that will be made available on certain types of cylinder construction.

"We all are familiar with the rapid rise

in octane which in itself makes an increase in horsepower available at a low cost to the operator. New developments in high turbulence combustion will raise the specific output of piston engines and will go a long way in reducing the minimum octane requirements. Low-cost fuel injection also is around the corner as far as small piston engines are concerned, and we know the advantages of fuel injection in the matter of fuel economy, better distribution and greater reliability with less hazard from icing, etc.

"The small engine can be compounded to give dual-engine reliability in a single-engine installation. Other developments which will give the engine more reliability, make it lighter weight, etc., include electronic ignition. There remains a considerable amount of work to be done on this, but when we get it, it will be an ignition system that will fire plugs no matter how badly they are fouled, and will reduce radio suppression requirements at altitude.

"Along with the electronic ignition, there can be electronic filtration which, in my mind, is a real necessity. Better filtration will extend the life of the engine. And if you want to go even a little bit further, we can visualize the use of electronically controlled valves which will give us flexibility in timing and optimum operations under any desired speed and power.

"The accepted use of the piston engine now, of course, is premised on the fact that there exists a history and background in the operation of this type powerplant. Right now, piston engines fill the bill for the conservative organization not willing to gamble too much on their transportation."

Til Peabody: *"Let's consider the turboprop and turbojet. Mr. Conlon?"*

E. W. Conlon: "Fairchild has a 1,000-lb thrust turbojet (J44) which has been in production for some time. This powerplant has been developed from a missile engine to a long-life powerplant for inhabited aircraft. A development program which is still continuing has resulted in marked improvement in fuel consumption and thrust available. Applications such as thrust-assist on transport aircraft are steadily increasing for this unit.

"Fairchild also is developing an entirely new small high-performance turbojet for the USAF which should have many commercial applications.

"Perhaps the most significant characteristic of turbojets from 1,000 to 4,000 lbs thrust is their steadily improving low specific weight, that is, pounds of dry weight per pound of thrust. We believe that 10 lbs. of thrust per pound of engine weight should be attained in the near future. Gas turbines, ducted fans, and turboprops are natural outgrowths of turbojet developments. Thus, in the near future the airplane designer will have a great deal more freedom of design, and characteristics such as vertical take-off should be readily attainable.

"The key to these new developments is adequate R & D dollars. The development of all of our large powerplants has been financed by the military. It appears that there will be a requirement in the military for the development of powerplants of the size required by executive transports. If this is so, then the performance requirements which you have indicated desirable for future executive transports can readily be obtained. Although the development costs are not large in terms of military R & D, financing such research independently is possible but would require coordinated effort of industry."

Til Peabody: *"What does Allison have to contribute in this crystal ball department with reference to the turbojet and turboprop powerplants?"*

Bob Reed: "Mr. Bowie mentioned a turboprop engine substantially higher in horsepower than the T-53. We at Allison are going into much higher horsepowers which are used by the military and the commercial airlines. Our engines will fit your needs for a long-range airplane, but that's all. Our power rating at the present time is about 2½ hp per pound of weight, but the ultimate goal is 4500 hp with the same engine which will give us 3 hp per pound. But you aren't going to be able to buy that horsepower cheaply. You've been talking here about a piston engine that costs you, surplus, about $2,000. If you want to jump into turboprop at the present time, its going to cost you a lot more.

"Every commercial user and small operator has found out that his basic costs must first be paid for by the military. No one person or one airline can stand the cost of developing a program on his own. In talking about an executive airplane, I don't believe those operators would have enough money to go into a large-scale turboprop development program. If you want to wait 10 years, it is possible that the engine as it stands today and if it continues in production will come down in cost, but you aren't going to buy horsepower cheaply.

"Fuel economy on the turboprop at the present time will match the reciprocating engine. Mr. Wiseman mentioned the octane rating of fuel. I think we all realize that as we go into higher octane ratings, costs go up. The turboprop will meet the specific fuel consumption of the best reciprocating engines of today. Kerosene or what we call JP4 fuel runs about half as much as the cost of high octane fuels. Therefore, operation from the fuel standpoint alone will be less.

"Looking at it from the overhaul standpoint, every engine which is developed has to go through growing pains. We didn't start out with a 1,000-hour engine. Whereas you are running your piston engines from 1,000 to 1,600 hours between overhauls, it's going to be a period of time before you get a turboprop that will run that long between overhauls. Therefore, while you save on your fuel bill, you go back up again on the overhaul costs. The first Allison turboprop engine coming out for commercial use is going to be rated at 600 hours. However, that will be jumped very quickly. At the present time we are running a test which simulate airline operations as far as ground idle, taxi, take-off, climb, cruise, let-down, etc., are concerned, and while we started it with a 600-hour engine, we're going to put it through 1,000 hours immediately.

"If we can develop a turboprop of that nature within two years, I think the cost will very nearly meet that of your reciprocating engine, that is, for fuel and overhaul. You still aren't going to get the initial product as cheaply as you have your piston engines.

"Allison is not building a small turbo-
op engine at this time. Later on, we may.
me of the executive operators are using
nvair 240's and we do have a conversion
whereby the turboprop can be installed
the standard 240. The cost runs pretty
gh, but if an operator wants that type of
craft, there's no reason why he can't use
r powerplant on that airplane."

l Peabody: *"From this discussion, I'd
the business-aircraft operator and the
plane manufacturer will be able to get
st about any type of powerplant they need
in the future, that is.*

*"Mr. Jamouneau, is Piper satisfied with
outlook for available power for its
ture aircraft?"*

alter C. Jamouneau (*Chief Engineer,
per Aircraft*) : "We recently put on the
rket a small twin-engine business air-
ft and have been gratified by its recep-
n. We have no special problems regard-
the range of power ratings available
the lower powered piston engines. The
nufacturers of this type have kept
reast of the power requirements and
ere is an ample choice of engines.

"For some time it has been our feeling
at new types of powerplants such as the
rboprop would be developed for the lower
wer requirements, and the work being
ne by several automobile companies on
s problem is of interest. It is worthy of
te that the first gasoline engines were
ed in automobiles, not airplanes, and
cordingly, much of the progress in the
craft industry can be attributed to de-
lopments in other industries. It is signifi-
nt that some of the builders of ground
hicles are considering the application of
s turbines to their machines, and as
nomics are a big factor in calculations,
is possible that the way may be pointed
ward low-cost small turbine powerplants.

"In the course of designing an airplane,
try to estimate the performance and
uipment requirements of the operator so
t it will sell in volume, and first costs
d operating costs are both kept as low
possible.

"We may come up with a machine that
a great success . . . or a total failure. The
rnacles are added because we have not
up the requirements correctly. If the
ss weight isn't sufficient, it's because we
ve not visualized, among other things,
progress of the accessory manufacturers.
member that they also have products to
l, and from their standpoint, the air-
ne is a platform to which the accessories
be attached. Be it external or internal,
adds weight and costs performance, so
t the airplane, as it was initially en-
ioned, cannot conceivably make allow-
ce for all of the new ideas and develop-
nts that will be brought forth in suc-
ding years.

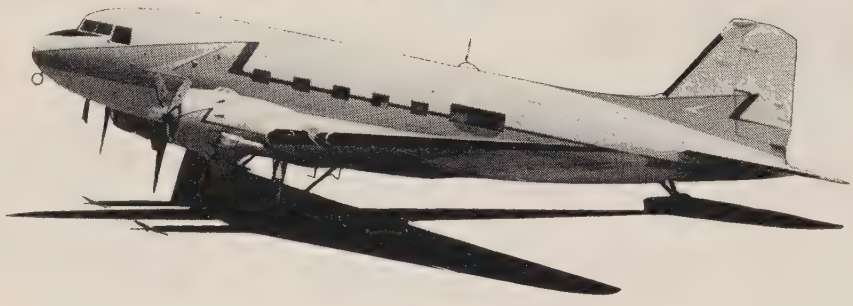
"To illustrate this point, at present there
much interest and development work on
omatic stabilizing devices, all of which
d to the burden to be carried by the air-
ne, and there is now discussion on
ether these should fall into the category
standard equipment. If a plane is to be
igned to carry all of the various com-
ations of instrumentation and equip-
nt possible, the conclusion would soon
reached that a light, low-cost airplane
s an impractical machine. A classic defi-

(*Continued on page* 48)

SKYMART

the Market Place for Aircraft Parts, Equipment, and Services

FOR SALE



IMMEDIATE DELIVERY

- Custom interior
- Four (4) picture windows (17" by 56")
- Custom cockpit
- Custom Radio Panel
- Custom Instrument Panel
- Custom Hydraulic System
- Airframe completely remanufactured and 8000 hr. overhaul.
  Heavy Ldg. gear
- Engine P & W 1830—92 zero time

Many Many other extras
CONTACT OWNER

For further information
Call or wire

Leeward
AERONAUTICAL SALES INC.
P.O. BOX 210 FORT WAYNE, INDIANA
P.O. BOX 233 INTERNATIONAL AIRPORT MIAMI 48, FLORIDA

The **FINEST** in Aircraft Radio

QUALITRON INCORPORATED

AIRCRAFT RADIO

Engineering
Installation
Maintenance

Distributor For

A.R.C. • BENDIX • COLLINS

Specialists
Executive Aircraft Radio Systems
Custom Edge-lighted Panels

Lockheed Air Terminal—at P.A.C.

BURBANK, CALIFORNIA

Th. 68317 **St. 75963**

*C.A.A. Repair Station No. 4083
Radio Class 1, 2 & Limited Radar

EXECUTIVE TRANSPORT AIRCRAFT

All Models
BEECHCRAFT LOCKHEED
CONVAIR GRUMMAN
DOUGLAS CESSNA
AERO COMMANDER

WELSCH AVIATION COMPANY

60 East 42nd Street, Suite 729
New York 17, New York Murray Hill 7-5884

SALE — LEASE

D18S BEECHCRAFT

AVAILABLE FOR IMMEDIATE SERVICE

Hydromatic propellers. 90 Hrs. Engines S.M.O. 340 Hrs. Airframe since 1000 Hr. inspection. De-icers, Anti-icers, 80 Gallon Nose Tank, and many other extras. Radio includes: Dual Bendix A.D.F., Dual A.R.C. Omni, A.R.C. and Collins Communications. Painted. Bargain at $42,500.00.

ATLANTIC AVIATION CORP.

Teterboro Airport Teterboro, N. J.
Phone: Hasbrouck Heights 8-1740

HELICOPTERS

HILLER

UH12B's

AVAILABLE FOR LEASE OR SALE

Complete spares for foreign operation. Float gear, etc.

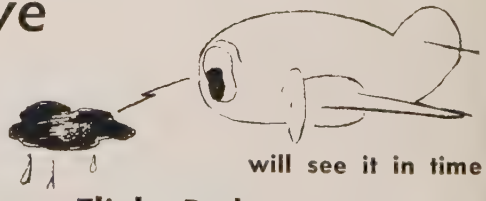
Reply to

Box 642 Skyways.

NAVCO INC.
Lambert Field
St. Louis, Mo.
PErshing 1-1710

Has all Parts and Supplies for Executive
DC-3 LODESTAR BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
F&W Continental Wright Goodrich Goodyear

Weather Eye



will see it in time

smaller, lighter **Flight Radar**

custom fitted to *your* plane with the latest, the most, and the best modern advancements in transistors, printed circuits, subminiature tubes, silicon diode rectifiers, imagination, and a few other nice things.

Weather Eye, P.O. Box, Bridgeton, Mo.

GENUINE NAVY INTERMEDIATE PILOT JACKET

U.S.N. ISSUE

$32.50

-FOR A LIMITED IME ONLY. Shipped ostpaid if remittance companies order.

rand new, Genine dark brown oatskin leather ith zippered ront. Bi-swing ack, two patch ockets, one inde snap pocket. outon fur collr, Celanese ned 100% wool cuffs and waist band.

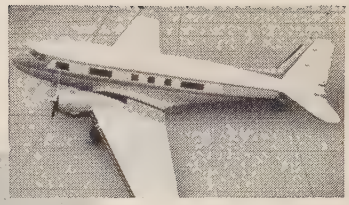
FINEST JACKET MADE

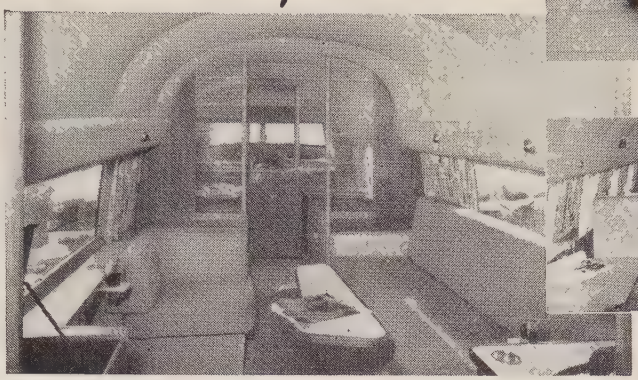
izes 34 to 46—$32.50; Sizes 48 to 50—$35.00
State Size Wanted

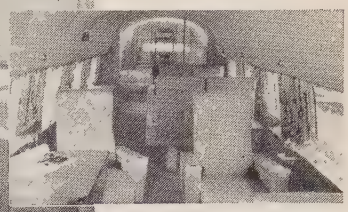
A clipping of this advertisement is not necessary when ordering)

FLYING EQUIPMENT SALES CO.
Dept. S
539-45 W. Wolfram St. Chicago, Ill.

NOW! The Real FORWARD LOOK
IN EXECUTIVE DC-3s
"The Tropicana"







- FULL FORWARD VISION FROM CABIN!
- 30% MORE CABIN SPACE FOR PASSENGERS!
- 300-DEGREE VIEW FROM 6 PANORAMIC WINDOWS! AND Luxurious Decorator-Styled Interior

NOW AVAILABLE FOR DEMONSTRATION AND IMMEDIATE DELIVERY

Unobstructed view for passengers! Soundly engineered for maximum safety and comfort! The new "Tropicana" model is L. B. Smith Aircraft Corporation's pace-setting executive DC-3!

210 MPH TRUE AIR SPEED

● Wright R1820-72AM1 engines... Hamilton Standard paddle blade propellers... geared rudder tab; 200,000 BTU heater installed aft. Radio and instruments include: Bendix TA 18B 180-channel 40 watt transmitter; ARC-1 50-channel transceiver; 2 51R2 VHF receivers; Omnimag; 2 RMIs; GlideSlope; 2 ADFs; Isolation amplifier; Sperry C-4 Gyrosyn compass; AM-FM cabin radio; cabin-cockpit interphone/PA system.

Buffet-bar; hot/cold food storage; king-sized lavatory; baggage compartment.

15 PASSENGERS

Second Production Model of the "Tropicana"

Now in work....can be completed to your personal specifications in: Engines, Instruments, Electronics, Radio, Interior and Exterior Color and any interior changes desired.

L. B. Smith AIRCRAFT CORPORATION

Write, wire or call: Herrol Bellomy, executive vice president
International Airport, Miami 48, Florida Phone: 64-0611

Remmert-Werner
for
RADAR

Bendix C-band
R. C. A. X-band
ambert Field St. Louis, Mo.

Aircraft Division

'RMAR RADIO SERVICE, INC.

CAA APPROVED REPAIR STATION #3598
RADIO CLASS 1 & 2

DESIGNERS AND MANUFACTURERS OF CUSTOM AIRCRAFT

Radio and Radar Systems

MACARTHUR AIRPORT
RONKONKOMA, L. I., N. Y.

Remmert-Werner

Inc. of **St. Louis** Lambert Field
Inc. of **Toledo** Express Airport

Specialists in
DC-3
Lodestar Maintenance Inspection
Twin Beech Overhaul Conversion

OXYGEN EQUIPMENT

SALES & SERVICE
REGULATORS — MASKS — VALVES
PORTABLES & CYLINDERS
FIXED INSTALLATIONS
GOV'T. APPROVED REPAIR STATION
ZEP AERO Phone: ORegon 8-1161
EL SEGUNDO, CALIFORNIA

We buy DC-3 and C-47

—also fuselages, center sections, components, etc. Prefer runout or needing work. Airline, passenger, cargo, Wright, Pratt & Whitney, etc. State Price, time, quantity, type engine.
We are not brokers

REMMERT-WERNER, Inc.
Lambert Field, St. Louis, Mo.

NAVCO INC.

Lambert Field
St. Louis, Mo.
PErshing 1-1710

has *Collins*
17L4–17M–51R–51V–51X–51Z
Communications—Navigation

BAYAIRE AVIONICS INCORPORATED

HANGAR No. 2
OAKLAND AIRPORT
LOckhaven 9-8385

RADIO SERVICE SALES

ARC • BENDIX • COLLINS • DARE • FLITE-TRONICS
ADF RADAR OMNI DME AUTOPILOT

Immediate Delivery

We stock, overhaul, and install

WRIGHT	PRATT & WHITNEY
R1820 —202, —56, —72	**R1830** —75, —92, —94

R2000 **R1340** **R985**

and our most popular DC3 engine
R1830 - SUPER - 92

ENGINE WORKS

Lambert Field Inc. St. Louis, Mo.

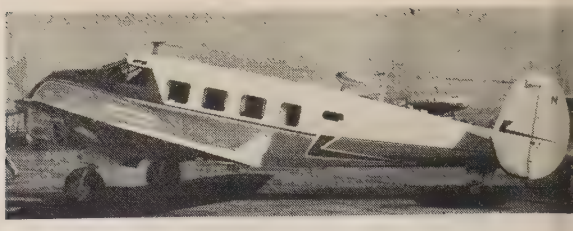
Advertising Rates Skymart Section

$15.00 per column inch for one to five issues, $14.00 per column inch for six to eleven issues, $12.00 per column inch for 12 issues on contract basis. Contract rates for space units up to full page, for classified type advertising, available on request. Unless otherwise specified all classified advertising accepted with the understanding that it will be placed in the first issue closing after receipt of order. Classified forms close 20th of month preceding date of issue.

SKYWAYS
122 EAST 42 ST.
NEW YORK 17, N.Y.

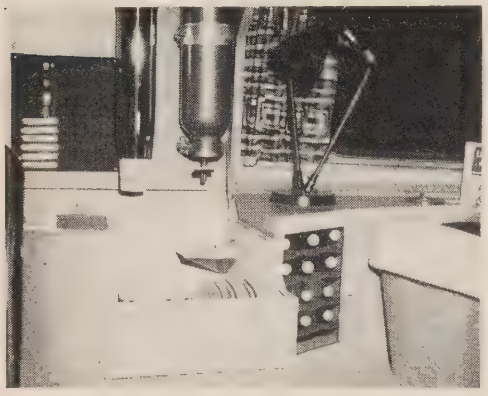
Modernize your Model 18 with a

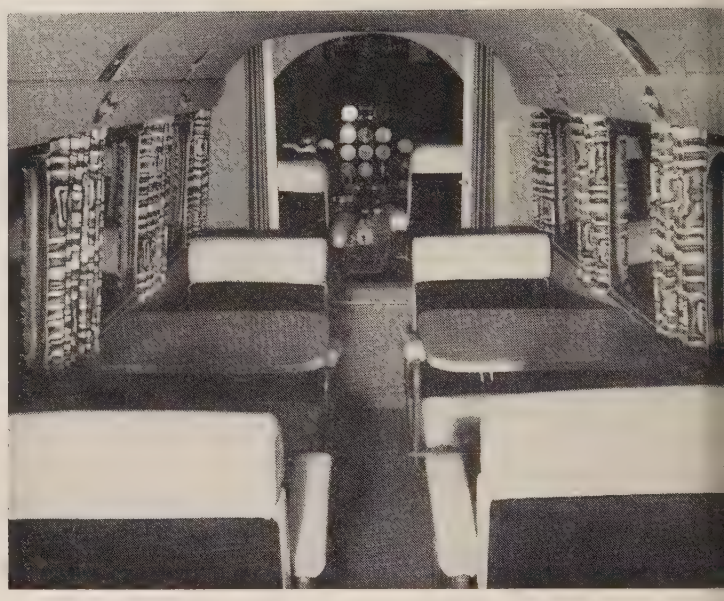
Custom 18



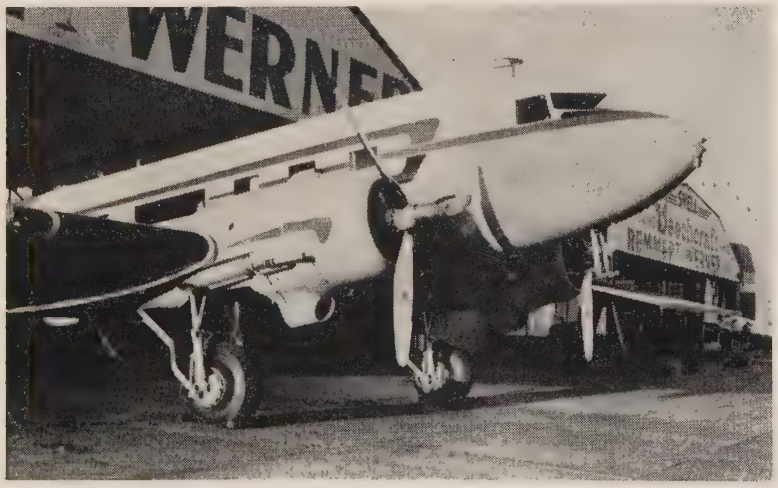
CONVERSION

Make your travels pleasant and refreshing, as you relax in a roomier, more convenient cockpit, or spread out luxuriously in comfortable, adjustable reclining chairs in the spacious new modern interior. Plenty of big windows for easy vision, and an ingeniously fitted snack bar for in flight meals or tidbits.





Immediately Available **—Custom D18S,** superior equipment



—and another new

SUPER-92 DC-3

for December delivery

with your choice of engines

Super-92
Pratt & Whitney R1830-75, -94, R2000
Wright R1820-56, -72

Bendix or Collins radio, new ship guarantee, complete 8000 hour overhaul, beautiful custom interior, big windows, 200 mph.

Specialists in

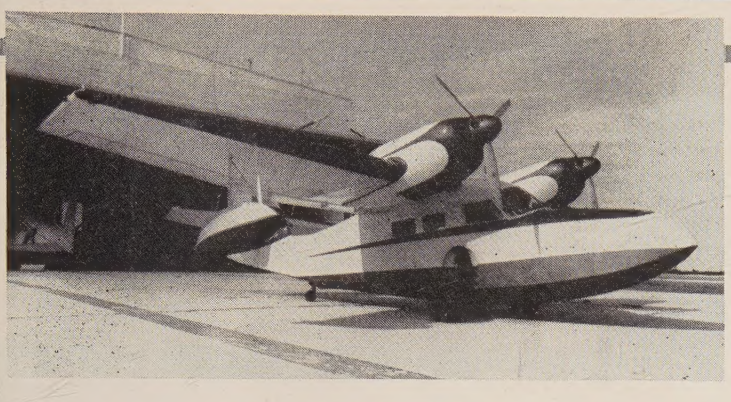
DC-3	Lodestar	D18S
Inspections Maintenance	Overhaul Conversions	Radios Engines Sales Parts

Remmert-Werner

Inc. of
Toledo
Express Airport

Inc. of
St. Louis
Lambert Field

SKYMART



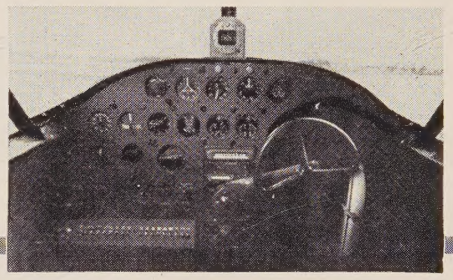
For sale by owner:

GRUMMAN SUPER WIDGEON

270 HP Engines 170 MPH Cruise

This aircraft has been completely outfitted to suit a discriminating corporate operator. It is beyond doubt one of the finest Super Widgeons ever built. $49,500

- Navy blue leather custom interior
- Beautiful metalic blue and buff exterior
- Engines—Lycoming GO-480-B1
  10 HR since new
  (Quiet overhead exhaust)
- Propellers—3-blade full feathering
  Hartzel 10 HR. since new
- Air Frame—40 HR. since major overhaul, painted and upholstered
- Radio—Lear LR-GA-1 VHF receiver
  Lear Cross Pointer Omni-range system
  Model 2214 converter
  Model 2215 omnimeter
  Lear LTRA-6 VHF-LF transceiver
  Lear ADF-12
  Narco VTIR-1 VHF-LF transceiver
- Complete Blind Instruments



Contact Clyde McClymonds

STORER BROADCASTING CO.
1177 Kane Concourse, Miami Beach 54, Florida
Phone Union 6-0211

★ CLASSIFIED ADVERTISING ★

Rates for Undisplayed Classified Advertising: 25c per word, minimum charge first 10 words $2.50, prepaid with order. Add 4 words if Box Number is included in lieu of advertiser's name and address.

AERONAUTICAL BOOKS

ARNING—CAA EXAMINATIONS ARE BE-G CHANGED. THE NEW OPEN BOOK EX-MINATION IS NOW OFFERED THE COM-ERCIAL PILOT. PREPARE FOR YOUR ATING WITH RELIABLE ZWENG BOOKS. ie following outstanding books by Charles Zweng lead the field and prepare you for ur rating. Included with each book are thentic examinations with new material t available elsewhere. Also included is a e Government Weather Map pertinent to e examinations. Why take a chance? veng books include: Airline Transport Pilot ting $5.00; Flight Instructor $5.00; New vised "Flight Engineer Rating Book" $5.00; nk Instructor $4.00; Private & Commercial ting (with text material to aid you in the ew Open Book Examinations") $4.00; Ra- and Instrument Flying (with new ex-inations) $5.00; Meteorology for Airmen 00; Aircraft and Engine Mechanic includ- hydraulics, weight, balance and new ctrical examinations $5.00; Flight Dis-tcher including Control Tower rating 00; Zweng Aviation Dictionary $6.00; ound Instructor Rating $4.00; Leading Air-e Executives and Pilots owe their success early training with Zweng books, each ok averaging more than 300 pages of vital terial. Pan American Navigation Service, 21-22 Ventura Blvd., N. Hollywood, Cal. ree Catalog—Air and Marine).

AERONAUTICAL PUBLICATIONS

NEW CAA EXAMS!!!! Did you know that the CAA has recently changed their exams? They are now using a new type "Open Book Exam" on some of their examinations. Obtain your CAA licenses by using a new Ross Guaranteed Questionnaire which includes the new "Open Book" type examinations. Our frequent revisions insure your receiving the latest Exams including navigation and meteorology maps. Order today: "Commercial Pilot $5.00"; "Instrument Pilot $5.00"; "Airline Transport Pilot $5.00"; "Flight Instructor $4.00"; "Private Pilot $1.00"; "Engine Mechanic $4.00"; "Aircraft Mechanic $4.00"; "Ground Instructor $5.00"; "Parachute Rigger $4.00"; "Control Tower Operator $4.00"; "New CAR for pilots 50¢." Special Limited Offer; A complete Ross Library consisting of the above 12 books for only $15.00. This introductory offer is for a limited time only, so take advantage of its savings today! Order Postpaid or C.O.D., Direct from Ross Aero Publishers, Administration Bldg., Box 7071S, Cherokee Airport, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

AVIATION Operators-Flight Schools. Attractive dealerships are still open throughout the country. Apply now. Pan American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

CHARTS & MAPS

AVIATION Charts now available from our new Chart Division. Agents for the Coast and Geodetic Survey. Our service includes Aeronautical Sectional, World Aeronautical, Direction Finding, Navigational Flight, etc. Distributors for New Plastic Relief Map of the United States $45.00 express prepaid. (Free Catalog.) Pan American Navigation Service. 12021-22 Ventura Blvd., Hollywood, Calif.

EXECUTIVE TRANSPORT AIRCRAFT

FOR COMPLETE market reports of available Beech, Convair, Curtiss, Douglas, Grumman, Lockheed or other multi-engine aircraft, write or call William C. Wold Associates, 516 Fifth Ave., New York 36, N. Y., Telephone Murray Hill 7-2050.

HELP WANTED

WANTED—AIRCRAFT RADIO MECHANIC Experienced on Collins, A. R. C., Lear. Openings for top qualified personnel. Atlantic Aviation Corporation, Teterboro Airport, Teterboro, N. J. HA 8-1740.

CLASSIFIED ADVERTISING

(*Continued from page 47*)

POSITION WANTED

INVENTOR WANTS GOOD POSITION with manufacturer designing, constructing aircraft engines. Skyways Box 700.

MISCELLANEOUS

$2.00 can save you hundreds. It's NEW ! ! Now you can receive information each month on hundreds of aircraft for sale throughout the United States. At a glance you will know what is available, hours, date licensed, price, etc., of practically every type of airplane manufactured. We tell you who owns the aircraft and you deal direct, saving time, eliminating hours of travel, and by knowing the market you get the best deal possible. You can receive your first copy listing aircraft for sale IMMEDIATELY. DON'T WAIT! Send $2.00 TODAY for a full year's subscription. Flyer's Market published by Aircraft Listing Bureau, 5305 Congress St., Chicago 16, Ill.

Round Table

(*Continued from page 43*)

nition of an airplane is that it is a machine that just barely flies. We seem to approach that point after a particular model has been in production for several years, during which added equipment and comfort items dictate an increase in engine power.

"If gas turbines offering ample power become available, attention will shift to the slow-speed characteristics as the airplane must be landed, and that is a problem which may be the equal of power problem.

"To summarize our thoughts, we feel that the piston-type powerplants are entirely adequate for the present, but both engine manufacturers and the airplane builders are looking forward hopefully to other types of powerplants which must be shown to be an economic practicality."

Blackie Martin: "Isn't it correct that we do not have a powerplant that will power an aircraft to replace the DC-3?"

Ralph Harmon: "I think there are such powerplants, but it depends solely on the approach you take. Brute horsepower is not necessarily the way to solve all these problems. Due to engineering emphasis on the efficient use of available horsepower, these new designs will produce some rather pleasant results. I think that has been proved in design of some of the smaller aircraft, particularly the small twins. Some of these techniques have not been applied to larger aircraft because we have not designed an airplane in that category for years.

"The engine that is used to get the power required you can't categorically say is this amount or that amount. When you efficiently use the power and integrate the engine, the configuration of the airplane and performance into one particular airplane. Power problem becomes peculiar to that airplane alone. Some of the present airplanes we are using are not well integrated.

"I think you can expect some gratifying results from modern engineering applied to the newer aircraft on the boards."

Til Peabody: *"Gentlemen, it is significant that this round table on power requirements for future business aircraft should end up in a discussion of the old workhorse, the DC-3. I guess we are going to see that aircraft for some time to come."*

INDEX OF ADVERTISERS

SKYWAYS—DECEMBER, 1955

Executive meeting "upstairs"

BEECHCRAFT SUPER 18

There's no time lost by the efficient executive team of the R. Company. Traveling by company plane to inspect a new plant site 400 miles away, they get there quickly and free of restricting schedules — and they get plenty of work done on the way.

When they set down at one of more than 600 Esso Dealer Airports, their pilot may use his Esso Aviation Credit Card to charge high-quality Esso Aviation fuels and lubricants, tire and battery service, landing fees, overnight storage and minor emergency repairs.

The growing corps of business flyers is learning to depend more and more on famous Esso Aviation Products — used by the world's largest airlines and backed by over 45 years of flight testing and research.

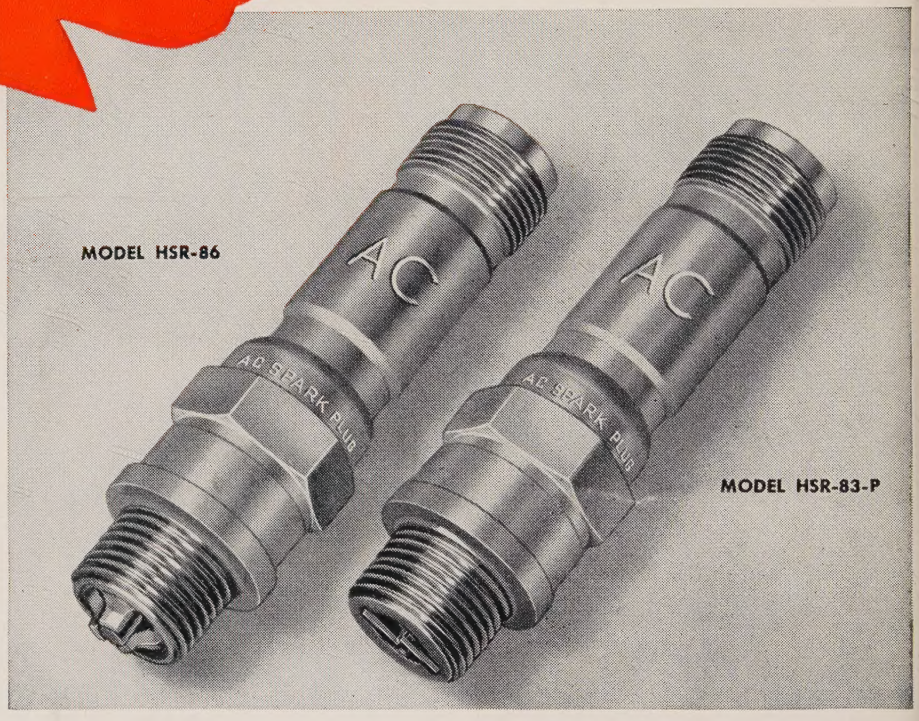
Esso

AVIATION PRODUCTS

NEW...

TWO MOISTURE-PROOF SHORT-REACH AC SPARK PLUGS!

For the first time, an aircraft spark plug for lower-power-output engines is completely sealed against moisture, oil, and dirt.



AC engineers announce a great new development in the aircraft spark plug field!

Now, short-reach plugs have all the advantages of AC's famous "high-altitude" all-weather spark plugs . . . advantages that have proved themselves in millions of hours of flight in America's military planes and leading airlines.

Completely sealed around the top of the insulator, these new short-reach spark plugs keep out moisture and prevent flash-over even under seaplane operating conditions. And, in addition, you can expect *twice the life of ordinary spark plugs!* Have a new set installed now!

Models HSR-86 and HSR-83-P are ¾—20 barrel size. For standard ⅝—24 harnesses, AC also produces the S-86-R and SR-83-P.

AC AIRCRAFT SPARK PLUGS

AC SPARK PLUG DIVISION GM GENERAL MOTORS GENERAL MOTORS CORPORATION • FLINT, MICHIGAN

DISTRIBUTED BY: **Airwork Corporation:** Millville, New Jersey; Miami Springs, Florida; Newark, New Jersey; Atlanta, Georgia; Arlington, Virginia. **Pacific Airmotive Corporation:** Burbank, California; Seattle, Washington; Oakland, California; Kansas City, Kansas; Denver, Colorado; Linden, New Jersey. **Southwest Airmotive Company:** Dallas, Texas. **Van Dusen Aircraft Supplies, Inc.:** Minneapolis, Minnesota; Teterboro, New Jersey; East Boston, Massachusetts; Alexandria, Virginia. **Standard Aero Engine Ltd.:** Winnipeg, Manitoba; Vancouver, B.C.; Edmonton, Alberta.